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RESEARCH TITLE

THE ASSESSMENT OF EFFECTS OF MEMORY STRATEGIES ON A SAMPLE OF INTERMEDIATE SCHOOL ADOLESCENTS IN KSA

PREPARED BY:

IBRAHIM ALYAMI

SUPERVISED BY:

Dr. SUSAN CHIPCHASE

DR. KAREN PFEFFER

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Abstract

This thesis is focused on assessing the impact of memory strategies among adolescents in Saudi Arabia. A mixed-methods approach has been used to analyse the impact of memory strategies among the sample of intermediate schools, adolescents, and undergraduate students in KSA. Four types of memory strategies, namely, self-test, mental practice, written rehearsal, and practice aloud, were used in this research. This research evaluated the impact of memory strategy on different age-groups of adolescents starting from 14-17 years. A total number of four studies were conducted for the purpose of attaining the aim and objectives of this thesis.

The aim of the first study was to identify the types of memory strategies that are used by adolescents and the identification of any interrelationship between student grades and the types of memory strategies used. For this purpose, a survey was conducted with 175 adolescents from the third grade of middle schools in Gizan, Saudi Arabia. A simple linear regression analysis was used in this study to predict adolescents' feelings of success after the use of different memory strategies. This was executed by analysing their scores associated with different subjects, including English, Arabic, Quran, and Science. The study findings indicated that the four common memory strategies used by adolescents studying in Saudi schools included self-test, rehearsal, practising, and mental practice. It was further identified that these strategies helped them in recalling information and boosting learning skills, which was reflected through their good scores in subjects like English.

The second study is aimed at gaining insight into the views of teachers in Saudi Arabian middle schools. It was based on the significance of memory strategies in boosting student learning. In this study, an interview was conducted with 18 teachers teaching various subjects, including Quran, Arabic Language, Science, Maths, and English Language. It was

revealed from the findings that teachers of intermediate schools in KSA prefer to motivate adolescents to adopt memory strategies like a rehearsal, mental practice and self-test. This was because they perceived memory strategies as an effective means of developing the learning capabilities of adolescents for different subjects where the use of memorising was necessary to succeed or excel.

The aim of the third study was to pilot the methodologies for study four so that validity of the research method and instruments can be checked and to identify the effectiveness of memory strategies for 42 Saudi Arabian undergraduate students at the University of Lincoln, with an average age of 19.45 years. The data collected in this study through interviews were analysed with the help of content analysis, and data from a survey was analysed through statistical analysis. It was identified from the study that students who utilised memory strategies were able to succeed in regard to learning and recalling new words. The study findings also revealed that there was a significant difference in the scores of the students after providing them with memory training. It was also identified that mean scores of students in recalling a word was significantly higher for the self-test as compared to other memory strategies such as the rehearsal, practice aloud, and mental practice. Furthermore, it was also identified that memory strategies helped students in enhancing their background knowledge, motivation, engagement, and memorising, which in turn assisted them in quickly recalling the content taught by the teachers.

The fourth study in this research was a full-scale study, which was aimed at analysing the importance of memory strategies with regard to a sample of 120 adolescents selected from third-graders at intermediate schools in the KSA, within an age range of 14-17 years. The study comprised 120 adolescents, including 77 boys and 43 girls, both in control groups and intervention groups. The participants were given a list of words to memorise using a particular memory strategy. Further, a memory test was conducted, wherein participants were

given a specified time to recall a word, which had been learnt using four different types of memory strategy, including self-test, mental practice, practice aloud, and written rehearsal. In order to test the memory, participants were given 1 point for a correctly recalled word and 0 points for wrongly remembered words.

In conclusion, a mixed-methods approach was used as a means of accomplishing the aim and objectives of each study, and survey and interview methods were employed as a data collection tool. Overall the study findings depicted that memory strategy significantly influence the behaviour of adolescents, but do not affect the memory behaviour of undergraduate students. The adolescents have already formed their memory behaviour; thus, the memory strategies are not effective for them. Findings of the studies have reflected that there is a difference in memory strategies when students report the memory strategies they use in their school life and the teachers' report on adolescents' behaviour, but there are no differences observed in the memory performance when students received training in different memory strategies.

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Chapter One

Introduction

It can be argued that human thinking is limited without memory. Memory is a necessary condition for mental life and the primary grounds for psychological growth. Without memory, the individual repeats everything as if he/she is performing it for the first time, and effectiveness in-memory strategies is needed to provide a clear context, which can help to organise the information (Mansour, 1984).

According to AbdElkhalek (1993), memory is the most important mental process in human life and includes a number of other processes such as learning, thinking, and problem-solving in general. Due to this, the importance of memory in the learning process has been observed, and specialists in educational psychology have tried to explain the process of learning through learning theories like Gestalt theory and Memory Trace theory. The Gestalt theory emphasises that perception and experience of the learner significantly affect their learning. Memory Trace theory presents a theoretical model to explain the processes through which memories are stored in the brain (Hamlyn, 2017; Goldmeier, 2014). Goldmeier (2014) found that memory is not stored in a particular part of the brain; however, it is generalised throughout the brain structure.

Memory primarily refers to the capability of an individual to store, hold and recall details and information. It is a brain-wide procedure in which different areas of the brain work simultaneously with the intent to recall the required information and experiences (Hamlyn, 2017; Goldmeier, 2014).

Memory is the foundation to enhance learning, both in the education domain and beyond. It can be said that adolescents having a good memory will be able to perform well in school, give an excellent performance in examinations, and attain better grades. However, it

is important to know that no-one is born with effective memory skills: adolescents need to develop and nurture such skills with time. The more they use such skills, the more they hone their memory. In order to boost the memory of children, parents need to make sure that their child is regularly working to strengthen memorisation muscles (Gathercole & Alloway, 2008). Effective memory can be classified into two parts: short-term and long-term memory. Adolescents can process and recall additional information with the aid of short-term memory. It aids them in tackling the task in hand. Such information is then transmitted to long-term memory that helps adolescents in gaining a proper understanding of any topic. However, most adolescents have serious issues in memorising as they feel organising and extracting worthy information about any subject or topic is a complicated task. This can result in children lagging behind and witnessing problems concerning academic studies.Therefore, the organization of memory is very crucial to access and retrieve information and make use of the information to make a decision, solve problems and interact with people. One of the ways of organization of memory is a semantic network model that states that there are various triggers that activate the memory about related things and helps in the organization of memory.(Gathercole & Alloway, 2008).

Memory is an integral attribute of human beings. Now, more than ever, scientists are making efforts to explore the secrets of strengthening memory. Memory is crucial to educators, not only for them at a personal level because, as they age, they are concerned about failing memory, but most importantly because memory plays a leading role in the teaching and learning process. Many people associate the term memory with the recall of specific facts or dates or lists of information and a combination of instructions, requiring effort and memorisation. However, memory goes beyond this one-dimensional aspect of learning, and instead, the emphasis is on attending, linking, remembering and utilising a thousand pieces of skills and knowledge constantly encountered by an individual. Memory,

for educators, is the only evidence that something has been learned. If teaching takes place without any learning on the part of the students, then there is no value in teaching (Jensen, 2005). Educators need to be assured that adolescents attend to learning, attach new learning to past learning, actively engage in learning or showcase their learning. All such things require memory. No real educator is merely interested in teaching; rather, his or her ultimate goal is to enable adolescents to learn. Educators want learners to have the ability to organize, storing and retrieving skills and knowledge. By envisaging what we know regarding the learning and memorising process of the brain, educators can concentrate on the learning domain of the learning and teaching process (Dehn, 2011).

Consequently, a number of strategies may be employed to enhance the learning and memory process. One of the most widely-used general memory strategies is what is known as spaced practice, and it entails spacing of study time over a long duration. Instead of following the practice of studying the night before, adolescents can follow the practice of routinely studying for two hours a day. This permits consolidation of information in the long-term memory. Spaced practise also helps in the information being well-organised in long-term memory. Breaking tasks down is another strategy complementing spaced practice. Instead of trying to cram by studying important material during one long study session, then learners can study only two or three chapters during a concise, spaced study period (Dehn, 2011). This practice will help in keeping learners focussed because they need not feel rushed into learning all the material at one point in time.

1.1 Literature Review

1.2 Overview

In this section, the diversified secondary research material pertaining to the memory from different time spans has been studied. This section includes journal articles describing the role and importance of memory in human beings. As the research study aims to analyse the role and importance of different types of memory strategies used by adolescents, the literature section highlights the importance of long-term memory in learning basic life skills. Along with this, the selected secondary material or articles also show the importance of plans and daily reminders in strengthening the memory system. Under the literature section, the articles reflect the way the long-term memory of individuals helps their learning mechanism. In this section, the opinions of different authors have been analysed to get a more detailed view about memory and its functions in day-to-day life. The articles also reflect the working procedure and mechanism of long-term memory and the manner in which it helps in shaping the overall behaviour of a person.

According to Forcato, Rodríguez & Pedreira (2011), human memory is not the same at all the time; rather, it varies according to age and strength. The cognitive psychology believes that the memory can be rebuilt at retrieval. The results of the study show that when people are given timely cue-reminders; this helps them to strengthen their memory and people perform better. The use of cue-reminders reduces the chances of errors as people are able to remember things more accurately and this improves their memory (Forcato, Rodríguez & Pedreira, 2011). Hence, it can be summarised from this article that timely reminders help in building and strengthening our memory. On the other hand, it is reviewed by Buuren *et al.* (2014) that participants were asked to memorise association between objects and location with the help of non-schema layout and schema layout. In this process of

remembering objects with location, schema layout was kept consistent while the non-schema layout was changed with time. The results of the study show that schema or a plan helps in better retrieval of memory and facilitates the reconstruction of information from memory. It was observed that schema layout helped participants to have a better object-location association (Buuren et al., 2014). Thus, it is inferred that this study highlights the importance of schema layouts in memorising the information and how schema layouts improve the overall memory of an individual.

While In contrast to above, it is reviewed by Holland & Smulders (2010) that there are different types of memories in humans and episodic memory is the one which reflects a collection of our past experiences. The study shows that when people were asked to remember some events from their past, a large number of participants made use of episodic memory to answer WWW questions from their past. It shows that along with other memory strategies, most individuals use their episodic memory to solve what, where and when questions (Holland & Smulders, 2010). Thus it is inferred that episodic memory helps in remembering the past experiences and in answering the WWW questions related to past. On the other hand, Raio *et al.* (2014) reviewed that human memory is highly affected by stress as stress hormones not only harm the memory of humans but also impact the modulating learning of humans. People have busy schedules and do not find time for themselves, the long working hours and workload increases stress among people. In case, people experience a huge amount of stress, the level of glucocorticoid rises in their brain, which leads to memory retrieval impairments (Raio*et al.*, 2014). Thus it can be analysed form this study that memory of an individual is negatively affected by large amount of stress which weakens the memory system of an individual. In the same line, Schwabe & Wolf (2013) reviewed that humans have different types of memory systems and they all work together for the overall working of the memory process; however, stress adversely affects the entire memory system. Stress

impacts the performance of individuals and reduces the hippocampal activities among humans, which lays adverse effects on the organising, storing and memory formation functions (Schwabe& Wolf, 2013). Thus it can be summarized that stress and memory of an individual are related to each other and large amount of stress mismanages the working mechanism of memory system.

However, as per the view of Chang, Jo & Lu (2011), memory is an essential part of the human body and helps the individual learn and memorize new things. It is an essential building block that helps individuals in making decisions based on their present knowledge. The memory can be divided into 2 main divisions, namely short-term memory and long-term memory. Short-term memory is when an individual remembers the thing only for some seconds or for some minutes. In long-term memory, individuals can remember things for hours, weeks, or even for a lifetime. However, an individual's memory is an unstable component that is repeatedly shaped from time to time (Chang, Jo & Lu, 2011). Thus it can be obtained that memory of an individual can be categorized in 2 main parts namely short-term memory and long-term memory. On the other hand, Jeneson & Squire (2020) reviewed that the brain has organized its memory functions according to the tasks and activities that it performs. Long-term memory refers to the memory that a person develops from past experiences while working memory or immediate memory is required to learn the present information. Long-term memory is that part of memory, which helps retain a large number of information for a long time interval (Jeneson & Squire, 2020). Thus it can be inferred that long-term memory of an individual retains the information for long period of time and helps in shaping the overall memory of an individual.

On the other hand, according to Hanslmayr, Staudigl & Fellner (2012), brain oscillations are the process in which many neurons work towards some specific cell assembly and play a significant role in shaping the memory of an individual. These oscillations in the

brain are also responsible for the retrieval and storage of long-term memory. Desynchronization in the brain refers to the process in which the post-stimulus decreases as compared to pre-stimulus, and it is identified that neural desynchronization in the brain positively affects the long-term memory and helps in the retrieval of long-term memory by decreasing the frequency of alpha and beta frequency band (Hanslmayr, Staudigl & Fellner, 2012). Thus it can be summarized that neural desynchronization plays a major role in shaping the long-term memory of an individual. On the other hand, Norris (2017) stated that memory be it long-term memory or short-term memory, is active when an individual performs any task. Both the memories work together in a task and are different from each other (Norris, 2017). Thus it can be inferred that short-term and long-term memories actively participate in tasks and build the overall memory of a person.

In contrary to the above, Lubin *et al.* (2011) state that memory formation is a very complicated process, and there are various steps involved in forming long-term memory. Long-term memory formation involves a process in which 2 types of synaptic plastic long-term depression (LTD) and long-term potentiation (LTP), mark the formation of long-term memory. The study identified that DNA methylation and histone methylation are critical factors that contribute in the formation of long-term memory. DNA methylation is when five main positions of DNA base cytocine are attached to the methyl group. This DNA methylation process positively affects the process of gene transcription and facilitates growth and development, and helps in forming long-term memory. On the other hand, histone methylation also affects gene transcription and shows 2 types of gene transcription effects. They either turn the gene transcription on or off and highly affect long-term memory (Lubin *et al.*, 2011). Thus it can be obtained that the overall mechanism of memory formation is a very long process in which long-term potentiation (LTP) and long-term depression (LTD) play a major role in long-term memory formation.

1.3 Summary

It can be summarized from the literary articles that the memory of an individual is an essential component of human life that helps in building the overall behavior and skills of an individual. Human memory changes according to time and age and is mainly of two types, namely long-term memory and short-term memory. The long–term memory of an individual helps them in retaining information for a long time while the short-term memory retains information for a short period. As the study is based on the memory strategies of adolescents, this section helps in building a strong research base for the study and highlights the role and importance of different types of memories. This section is significant as it enhances the knowledge of an individual regarding the mechanism and development of long-term memory; this section is relevant to the study as it can help the researcher in gaining a thorough understanding of the different types of memory strategies applied by adolescents. This section provides knowledge about long-term memory that can help in determining the most effective memory strategies used by adolescents and in identifying the reasons behind the results generated.

1.4 Background to the Study

Memory strategies are techniques that can be used for the purpose of learning and retaining new knowledge. In the context of school adolescents, it has been found that many adolescents have memory issues and they are not able to register the relevant information in their minds, thereby facing difficulty in remembering instructions or guidance given to them. In this regard, memory strategies are helpful to increase the memory level of adolescents, as they help to provide direction in the form of verbal and visual formats. With respect to memory strategies, adolescents are able to enhance their reading capabilities and they help adolescents accomplish academic success, according to Swanson, Lussier and Orosco (2015).

For strengthening the memory and increasing retention of memory among intermediate level adolescents, memory strategies are techniques that are designed to increase the focus and attention of adolescents. These strategies help in structuring and organising study material, and utilising mnemonic devices. It has been ascertained that reading out loud is beneficial for adolescents because it significantly improves memory and assists in visualising the concept through photos, graphics and charts (Shing & Brod, 2016). On this basis, it has been theorised that to improve the memory level or sharpen the memory of intermediate school adolescents in the Kingdom of Saudi Arabia (KSA), memory strategies or techniques are important and these are helpful methods by which adolescents are able to achieve academic success.

The purpose of this research is to identify the effectiveness of certain memory strategies on intermediate school adolescents in KSA. It is important because it may improve the memory level of KSA adolescents, as their learning and thinking ability gets enhanced with the help of memory strategies, which act as a useful tool. The research has been conducted to focus on adolescents because it comprises an age group where people need regular practice for remembering critical aspects in a more efficient and effective way. The age group range of adolescents within the current study is between 14 and 17 years, and middle schools in KSA have been chosen because there is a need to develop communicative competencies among these adolescents. Additional research for the present study has found that previous studies have been conducted on younger children; therefore there is a need to target adolescents and explore their use of memory strategies. This is important because there may be significant differences in the age groups.

As per Fuzzy-Trace theory, such kind of false memory is governed by two different forms of memory processing (Reyna *et al.*, 2016). In particular, gist processing acquires

important information about studied materials or experience and, in contrast, item-specific processing or verbatim preserves the content and emphasises perceptual information, as well as specific attributes of experienced items. Item-pertinent processing enables effective differentiation of different facts from similar or linked scenarios but places extensive demand on additional resources. On the other side, gist processing permits storage of the important details in the form of compact event records (Zhang *et al.,* 2016).

In the case of individuals that are elderly, it is observed that the functional decline that occurs due to age of the frontal lobes and temporal lobes can result into cognitive resources that are constrained (Borson, 2010). However, this is not the case with adolescents as they are highly dependent only on memory tactics that have limited attentional resources like gist based processing, thus, very less monitoring is available during the retrieval process (Albert & Steinberg, 2011).Thus, it is difficult for people to screen and accurately reject the associated but unexplored items from explored ones, which in turn contributes to rising susceptibility for associative memory illusions. However, an age-connected rise in associative memory illusion does reveal that it not only determines a rise in memory failures but also indicates an adaptive change in the processing approach.

In comparison to verbatim or item-specific information, gist information is essential for tasks like categorisation, comprehension and generalisation across different scenarios in routine life. As per a selective, optimisation and compensation model, also termed as SOC, from middle to older age, primary memory goals shift from thriving for gains to preventing or administering loss. When it is related to memory, the indispensable rise in associative memory distortions indicates the fact that saving the essentials of the past outweighs maximising the preservation of item-pertinent information. Higher levels of associative false recognitions foresee improved performance and enhanced problem-solving in the remote associates task. This is mainly because gist processing denotes information represents

underlying processes and information storage shared by both memorising the past and predicting the future. As an outcome, when attentional resources become scarce, such as in the context of natural ageing, leaning towards a gist-centred memory strategy for remembering the important information can be advantageous for older adults in attempting to differentiate explored items from the new ones (Zhang et al., 2016).

Adolescents have been initially recognised as giving high preference to gist-based processing, with environmental assistance such as repetitive studying denoting high false-recognition rates of the novel, related items in the starting trials. False recognition rates then reduce in subsequent trials, reflecting a switch to item-specific processing. Without substantial cognitive resources, adolescents have shown limited potential to pursue item-specific processing and when involved in divided attention conditions, younger individuals have shown compromised item-particular processing in relation to gist processing. It is suggested that considerable environmental support helps individuals to process distinctiveness and control false recognitions, although this may be enhanced by experience over a period of time.

1.5 Long-Term Memory

Long-term memory can be defined as the capacity for storing information for a long-time period or entire lifetime in the mind of humans. It is unlimited in nature and refers to the storage of information over an extended time period as this kind of memory is frequently accessed and becomes easier to recall, being considered as active memory. Long-term memory is a system which is used for permanently storing, managing and retrieving information or data for future use (LaRoia & Louis, 2011). Cognitive psychology theories identify three types of memory: long-term, short-term and working memory. Learning skills depend on memory retrievals such as through recall and recognition and these cannot be

achieved without memory strategies, which allow information to be transferred from the working memory to the long-term memory (Abhakorn, 2008; Kihlstrom, 2013; Baddeley, Eysenck and Anderson, 2009). Memory is the logical and cognitive process that leads to identifying temporal dimensions of the mind, and it can be depicted as the ability of encoding, storing and retaining, and thereafter, recalling that particular information and previous experience. In this regard, in order to increase the level of long-term memory, there is a need to engage multiple ways to represent particular information; for example, integrating stories that can align with an emotional connection for adolescents; it is also essential to use scenarios and simulations that help to access the previously learned subject matter (Nusbaum & Silvia, 2011).

In Baddeley, Eysenck and Anderson's research (2009), long-term memory (LTM) is the system that is assumed to support the capacity to store information over long periods of time; in other words, it is where information is stored and retrieved to recall experiences and education. LTM is divided into two types of memory, including explicit (declarative) memory, which is used to remember exact events in human life such as meeting friends, and implicit (non-declarative) memory, which focuses on human performance such as skills. Declarative memory is further divided into semantic and episodic memory. Semantic memory is the memory that is based on general factual information, concepts and knowledge regarding the world. In addition to this, non-declarative memory is of two types which are perceptual representation system and procedural memory (Abhakorn, 2008; Baddeley, Eysenck & Anderson, 2009; Kihlstrom, 2013). This study will focus on declarative (explicit) memory. Explicit (semantic) memory is important for adolescent learning in the Saudi Arabian school context. Semantic memory plays an essential role in enhancing the memory level of adolescents as it allows adolescents to remember facts they are learning. This kind of memory is helpful for adolescents because it enables the increasing of knowledge regarding

the world (Hills, Jones & Todd, 2012). In relation to this, semantic memory is essential for the KSA adolescents because it helps to increase their focus and attention regarding their educational courses and they can effectively understand the facts while learning and thus they will be able to achieve academic success.

Long-term memory primarily refers to the storage of information for an extended period of time. It is also considered as a stage in which informative knowledge is held for a more extended period of time, and it is the place where information is retained about past experiences and education (Brain, 2015). Some of the education and experiences restored in the long-term memory are easy to recall; however, others are quite difficult to access. All the long-term memories are not equally developed and grasped. In education, information that is significant and holds profound importance leads to robust recall; however, information with lesser importance is weaker and requires more reminders and prompts in order to bring into focus (Hendelman *et al.*, 2011).

The long-term memory is further divided into declarative memory and prospective memory. Prospective memory includes remembering the details in order to perform planned actions at some point of time in the future. Declarative memory includes facts, general and personal experiences. Further sub-types of declarative memory comprise episodic and semantic memory. Episodic memory refers to the memory that is associated with autobiographical events such as time, related emotions and places (Brain, 2015).

Semantic memory is recognised as long-term memory that involves ideas, events, concepts, and facts pertaining to scientific and historical data; it refers to a major division of long-term memory that includes knowledge of facts, events, ideas, and concepts. It involves common knowledge such as colour, capitals of countries, sounds of letters, and geographic

and political information that cannot be learned on their own and of which they have no personal experience (Binder and Desai, 2011).

During the course delivery, if the materials are being practised regularly, the concept becomes clearer in the mind of adolescents and details associated with the respective course work are more easily registered by the adolescents. When adolescents are regularly reading and are focused on their educational course outside the classroom, it becomes an easy practice for them as they can quickly recall the materials and content they had learnt in the classroom. When the information is accessed several times, it helps to enhance the ability of the neural network of the adolescents and the information is strongly encoded in these networks; hence, it becomes easier for the adolescents to recall the information (Hendelman et al., 2011). On the other hand, the memories and education that are not recalled frequently become weak or lost, and it becomes difficult for the adolescents to recall them. This may be when memory strategies can enhance such recall.

1.6 Memory Strategies

Memory is the most important part of the mental process as it is a link between events in the past and the present and it builds useful experiences for human thinking (Alkolay, 2004). In order to enhance memory and remembering capabilities, memory strategies are utilised widely (Weinert & Perlmitter, 2013). Because of the importance of memory in improving learning, previous studies have focused on methods that help in the recall, which are called memory strategies. These strategies are a group of methods which aim to organise information to make it easier for recall(as cited in Saudi, 1993)Also, Biehler and Snoman (1990) found that memory strategies were exciting and easy to learn, at the same time as being productive and useful for student achievement.

Memory strategies refer to the broad set of techniques that are designed with the intent to assist an individual to remember and enhance the memory. The basic principle underlying the use of these strategies is that we can increase memory performance by linking what we want to remember and something we know already. In addition, Paivio (2014) stated that his theory proposed in 1971 helped to understand how these strategies are based on the assumption that it is easy to recall any information from the memory if it is represented verbally and visually. Furthermore, it has been suggested by Ramirez *et al*. (2013) that mnemonic devices are strategic measures are helpful for retaining the information for tests as there are different types of methods that can be used to remember different kinds of information. These include rhymes, which form the oldest mechanism for memorising whole documents, and visual imagery that increases the creativity and attention of adolescents for remembering particular facts.

There are two main forms of memory strategies to enhance the memory and recalling process: external memory strategies and internal memory strategies. External memory strategies include everyday actions that are undertaken by individuals with the intent to remember things. In addition, the external memory tools assist the individuals by compensating for memory harm, and if these strategies and tools are utilised adequately, they can assist in reducing everyday memory problems (Young & Bramham, 2012). Some of the examples of external memory strategies include notepad/daily planner, calendars, list/check-list, and setting a timer. Internal memory strategies refer to focusing the attention in a specific manner and being mindful of particular details and information. The internal memory strategies include mental procedures to enhance memory and these strategies are quite difficult to apprehend and grasp. However, once these strategies are learned adequately, these are profoundly effective in improving memory among adolescents (Young & Bramham, 2012). The effective internal memory strategies include visualisation, categorisation, rote

learning, and association. Categorisation and visualisation assist in improving the prospective memory and rote learning helps in improving episodic memory.

Memory strategies are crucial to enhance the memory position or level of adolescents as these are the techniques, which strengthen the memory. Study classes is one of the memory strategies as these classes help to teach college adolescents about taking notes, studying for the exams and also ways to spread educational knowledge to the world. This kind of practice is helpful for the adolescents as it teaches them a skill that will enhance their learning experience. In addition, the four "R" strategy, which includes Review, Reread, Recite, and Rewrite, is also depicted as an effective memory strategy for adolescents because the method is associated with reviewing notes, which are taken during the class. Rereading the chapters that were discussed in the classroom is carried out and, after rereading the chapters, reciting a list of contents and facts helps to memorise the knowledge easily. Finally, it is necessary that adolescents rewrite the information they find to be relevant for their educational purposes (Fazio, DeWolf & Siegler, 2016). It has been found that this memory strategy is a brain exercise for adolescents as they are able to recall information several times and it also increases the chances of making the respective information a part of their long-term memory.

Researchers have long been interested in the memory strategies that improve learning (Eisenkraemer & Stein, 2015; Gaskill & Murphy, 2004; Kornell & Flanagan, 2014; Schlagmüller & Schneider, 2002). In this approach the terms of concepts that are required to be learned are placed into different categories to ease the learning process. Moreover, encoding refers to the initial stage of learning or perceiving the information and it helps in storing the information to memory. Appropriate encoding of information to memory assists adolescents in storing the information to long-term memory. For example, studies by

Schneider, Knopf, and Stefanek (2002) and Luciana *et al*. (2005) have provided evidence that sorting and encoding improves the scholastic performance of adolescents.

According to Karpicke (2016), retrieval-based learning practices are an effective medium for memorising things for a long time, compared to other learning strategies. In this regard, the authors have suggested that adolescents study educational content about science by using two or three memory strategies. Under a retrieval practice strategy, adolescents spent time in reading and writing the text as much as possible in order to remember it. Further, they read the text again in order to remember it and create a conceptual map; conceptual maps are considered as a node-and-link diagram that helps learners to think about the meaning and rationale of the texts and material.

Zhang *et al.* (2016) have provided a developmental perspective to illustrate the number of new bits that could be stored by adolescents and young children. It has been identified that there is a significant impact of age on memory. However, it has been elaborated that ageing does not always affect the memory of a person; those who are used to doing puzzles and crosswords that are depicted as brain games are highly mentally organised as their brain exercise has been performed regularly. Therefore, it is probable that those who are engaged with these kinds of activities, which help to develop the brain of an individual, are more likely able to enhance their memory level rather than those who are not involved in such mental exercises. As a result, it can be inferred that it is not necessary for adolescents to have the ability to store a wide range of information. Furthermore, as the information stored in the working memory is fragile and may be lost easily, it should be activated at specific time intervals to retain it for the long run. In this regard, the authors have demonstrated that adolescents should rehearse the information mentally, in order to retain it in the working memory for longer than 20 minutes.

Two types of rehearsals are normally utilised by the adolescents to keep the information in the mind for the long run, and these include maintenance rehearsal and elaborative rehearsal. Maintenance incorporates the rehearsal of information in one's mind. A person is able to maintain the information in the working memory by repeating it. Maintenance rehearsal is used to memorise the information, such as phone numbers. On the other hand, elaborative rehearsal helps the individuals to remember the information about which they already know something. Elaborative rehearsal helps to maintain the information in the long-term memory (Cockcroft, 2015). The authors have also described the impact of cognitive disability on the working memory. It has also been determined that the working memory of people with some form of cognitive disability is depicted by the mental age of a person; there is a connection between the cognitive ability and working memory for regular functioning of activities related to learning.

Apart from internal and external memory strategies, environmental memory strategies are also considered effective for enhancing memory. The environmental memory strategies include transforming the environment and modifying it in order to enhance the remembering processes. The environmental memory strategies include organisation approach, developing routine and managing things in sight (Addis, Barense & Duarte, 2015). The organisation strategy is considered a practical approach for enhancing the memory of adolescents. The big problem that faces professionals is trying to find the best strategies that adolescents can use and to provide information to the student in a way that makes them more able to store and retrieve it easily. Previous studies indicate that there are numerous memory strategies that adolescents use for remembering, such as loci, organisation, practice, narrative, rehearsal, visual and rhyme strategies (Keasey, 1990; Groninger, 1991; Bower & Clark, 1995).

Organisation strategy has been found to significantly improve recall when compared with other strategies such as spatial memory, which allows a student to imagine a familiar

place that helps him/her to remember, and the story memory strategy that makes a story of words in order to make associations (Alkolay, 2004; Johnson, Johnson & Smith, 1991; Tomlinson-Keasey, Crawford & Eisert, 1979). In addition, some studies of learning and memory found that practice and retrieval of information through testing the information has a clear effect on learning and long-term retention (Karpicke, Butler & Roediger III, 2009). Moreover, studies of meta-memory have found that college adolescents used the repeated reading of their notes or textbook while studying, but relatively few used self-testing or retrieval practice (Agarwal, Karpicke, Kang, Roediger & McDermott, 2008; Karpicke *et al.*, 2009).

The strategy of practising is also beneficial for college adolescents, as it helps in moving the concepts from short-term memory to long-term working memory. This strategy facilitates recalling of information and concepts in an adequate manner. Chunking is another effective memory strategy for adolescents, which includes breaking the information down into small chunks and then learning it. Chunking is considered an effective approach for remembering information for a longer period of time. Rehearsing is also a beneficial strategy for the student, as it helps in improving memory and remembering things. It also facilitates easy recalling of the information and details when they are required (Meltzer, 2010). Memory strategies are highly beneficial for the adolescents in order to improvise their learning capacities and to enhance their learning outcomes. Moreover, these strategies also help in improving the educational achievements of the adolescents, although different strategies may be more appropriate for different age groups.

1.7 Memory Strategies among School Adolescents

Memory strategies are highly beneficial for school adolescents, as they help in improving the long-term memory of the adolescents and enhancing their learning

achievements. Active memory strategies for the student include self-testing, practising, writing, chunking and rehearsing. These strategies are commonly utilised by the adolescents in the KSA schools, as they are practical and easy to grasp (Bergin and Bergin, 2016). The strategy of self-test assists the adolescents in remembering the study material, as well as evaluating knowledge gaps. Hence, it helps in identifying the areas that require attention and efforts to remember them.

In order to enhance the memory of school adolescents, there is a need to give them directions in multiple formats, including both visual and verbal. It is necessary to provide them with an understanding to memorise the instructions; moreover, there is also a need to give them the meaning of directions. Furthermore, adolescents must be taught to be active readers; it implies that when they are reading and repeating the information multiple times, it helps to enhance their long-term memory. It is necessary to give them guidance pertaining to highlighting and underlining some of the relevant sentences and then to reread those points, which can help to improve their memory. Using visual images is also an effective memory strategy as there is a need to make use of cues, which are the substitution words used for t information that is hard to visualise (Chen, 2014). Retrieval practice for the adolescents is also an effective memory strategy, and is the activity of recalling information that has been studied. With the help of non-scheduled tests or exams, teachers can find out from adolescents what they have learned previously, and with the help of such tests, school adolescents are able to recall previous knowledge.

In order to improve the memory of adolescents, which is key to refining adolescents' performance, a range of memory strategies can be employed and systematically applied. Among the varied theories of memory, information-processing explanations are most common and include connectionist or neutral-network approaches. The information process model is centred on interpreting and processing sensory data and convening such data into a

form that can be easily recalled. Interpreting sensory input entails determining whether it is to be memorised and associated with past knowledge, and then saved in a format that can be easily retrieved. Information processing, having its origin in computer science and communication, indicates that mental processes, such as memory, can be inferred as the flow of information comes via different stages (Jensen, 2005).

Educators are required to allocate time for rehearsals during classroom lessons. Teaching extensive information very rapidly is likely to be inefficient as, unless adolescents are provided time to rehearse every new piece of information mentally, subsequent information is likely to extract it out of their working memories. When teachers end a lesson by asking whether or not adolescents have any questions, they are actually offering a few moments to adolescents for thinking over and mentally rehearsing what they have learned. Further, teachers can ask adolescents to verbally repeat key elements of information either as an entire-class response or through making effective use of a cooperative learning tactic, also termed as Think-Pair-Share. The latter strategy entails having adolescents first pursue rehearsal on their own, and then verbally sharing key ideas or important points with one other student. Such forms of rehearsal activities assist adolescents in processing information within the working memory and thus develop the same in the long-term memory. The limitations of working memory can also be addressed via chunking and automaticity. Chunking denotes a process of integrating distinctive items into wide-reaching and useful units. Chunking consumes less space in the working memory in comparison to individual items of information, as chunked information is usually remembered as a single unit (Dehn, 2011).

Automaticity denotes the mental operations which can be executed with less awareness or via conscious effort. With the gradual development of automaticity, the time and efforts needed for performing tasks is dramatically reduced. Automaticity can be strengthened through practice. Normal learners generally need around 40 exposures to

information before it becomes entirely automatic. Adolescents with compassionate cognitive disabilities need approximately 200 exposures for information before its transmission to automatic. Adolescents, particularly with cognitive disabilities, have little space in their working memory. As they are being taught, it is important to understand how they can learn. A common mistake that is made by educators is to present significant information in a quick manner. Adolescents' working memories cannot always keep up. Further, pacing the information presented in a way that adolescents are left with sufficient time to process it well is anticipated to promote learning and advance memorising. Repeating the identical or similar information numerous times, stopping to note vital points on the overhead projector or board, and offering different examples with requisite illustrations promotes the informational processing in working memory (Dynes, 2017).

The potential of working memory to fulfil a learning task varies from one person to another. One of the crucial factors in advancing such capacity is background knowledge. The more an individual knows about something, the more the ability of a person to manage and absorb new information. Prior knowledge is not a sole factor, however, as individuals differ in their potential to organise information and can be taught to systematically use strategies for making optimum usage of their working memory capacity (Dynes, 2017). However, it requires some understanding of how the brain develops in adolescents to be able to select the optimum memory strategies for this age group.

1.8 Brain development in Adolescents

Adolescence refers to the phase of life that lies between late days of childhood and adulthood. According to Blakemore (2008), life passes through several phases and the transition stage between childhood and adulthood is termed adolescence. A range of neuroscientific descriptions or theories have been proposed, which provide a base for

methods that can be used to develop the brain of adolescence along with the development of the ability of thinking, the development of cognitive skills, an empathetic capacity (theory of mind) and face-recognition abilities are also altered (Blakemore, 2008, p 427). Additionally, the grouping of neural information increases with age, thereby reducing the neural activities that are irrelevant to activity, while the child and adolescent brain is less focal in comparison, as shown in functional imaging research for the developing brain (Blakemore, 2008). Brain development in the infant is completed not long after birth, with the cerebral cortex developing to its full size. Nevertheless, the adolescent brain undergoes continual development (Konrad, 2011, p 124-138).

It has been found by Blakemore, Burnett & Dahl (2010) that between the ages of 11 to 13 years, the brain of adolescents grows rapidly, as their nerve cells increase the number of nerve connections. This growth is basically followed by a period of pruning, which is a process s that leads to enabling the adolescents' brain to process more rapidly those tasks which are already known; however, it also decreases the level of learning of new and creative skills or acquiring new skills, which is an important aspect for the development of adolescents' brains. However, it has been found by Van de Kamp et al. (2015) that brain development serves as a motivation as all adults interact with each other to take care of adolescents. The brain of the adolescent is under construction or undergoing development that can be affected adversely by risk behaviours and also by the environment. Therefore, the brain development of adolescents is a sensitive time where it is necessary to improve the memory level of adolescents in regards to their future yet is should also be acknowledged that it is a time of high-risk behaviour for them, which can result in physical or self-harming and is often encountered during this time of vulnerability.

Nevertheless, there is cognitive development taking place; cognitive development refers to a change in the brain that prepares people to think and learn about respective

aspects. From childhood to t adolescence, there are several changes that have taken place in the brain of humans, which means that there is growth and development in the mind. It has been analysed that the brain is continually growing new cells, which implies that extra brain cells give more place to store the information, and it would be helpful to increase the learning skill of adolescents.

Cognitive changes lead to strengthening the connection between brain cells and enabling the adolescents to store information in the brain that can be used on a regular basis (Blakemore, 2012). Furthermore, it has been revealed that changes in adolescents have greatly impacted on their brain. These changes help to enhance their learning skills and bring advancement in their reasoning skills, which means that adolescents are able to identify the results of their actions by using logical options and understanding the different situations as these practices help them plan for a future course of action. Moreover, meta-cognition is a practice that allows adolescents to reflect on the answer and come up with a conclusion as this practice may be helpful for them to discover ways of improvement (Sloman, 2014). In this regard, changes in the brain of adolescents may help to increase their thinking level or memory, and they would be able to understand everything in a practical manner.

According to Wright & Kutcher (2016), the development of the brain takes place speedily in the first 3-4 years of life and all the building blocks of life are developed by the age of 9 years. The different centres of the brain evolve and become functional, integrated over time, and the last part to evolve is the pre-frontal lobe that occurs during the time period of adolescence. During this time period of life several things affect the development of brain, including environmental and individual factors, as well as genetics.

Adolescence is generally the developmental era during which children become mature socially, physically, hormonally and intellectually. The brain is thought to evolve and connect

functionally at different stages of life. The limbic system, which includes the emotional areas of the brain, is present at the time of birth, however, the modulation of emotions moves from shared responsibility with the parent to individual accountability in adolescence (Laursen & Hartl, 2013). This process of development of the brain requires new connections to be evolved between the critical level of thinking and the areas of the brain that are emotional, and it leads to decision-making and thinking at adult level (Konard, Firk & Uhlhaas, 2013).

Thus, it can be summarised that the brain of an individuals grows rapidly at the time when they are adolescents. However, some of the changes in the brain occurs at the time of puberty and some continue even after that. The changes in the brain of an individual is based on experience, age and hormones. During adolescence, the connections between the cells of the brain are strengthened and they are set for life, hence it is considered an essential stage for the development of the brain. This is why it is so important to consider how memory strategies can be used to best effect for adolescents. The focus of this thesis is on adolescents in Saudi Arabia and to understand how the education system works so that it can be explored how memory strategies may be best employed to enhance learning within this system.

1.9 Education in Saudi Arabia

The education system in the KSA requires adolescents to pass one stage before graduating to the next stage (Alhamdi, 2008), therefore, testing for school achievement is important. Also, there are some school subjects that need to be assessed at the end of the semester, based on the student's skill at remembering. These are Arabic poetry, new vocabulary in English and the Holy Qur'an. Therefore, there is a need to assess the use of memory strategies for school adolescents, as well as assessing teachers' opinions about whether they should teach memory strategies. This study is considered important for investigating recent memory strategies that have been used, and those which should be used,

for middle school adolescents (aged 15) in Saudi Arabia. Also, the study aims to provide a constructive way for adolescents to prepare for their examinations. The education system needs to provide strategies that help adolescents to organise new information, and recall and recognise it easier, which will encourage adolescents to adopt a more proactive approach to learning (Alghamdi, 2011; Kholi, 2004). There is currently little research addressing the question of how to help adolescents achieve and the role of memory strategies in school achievement in Saudi Arabia as the thesis was focused on mental visualisation and material properties in education strategies(as cited in Saudi, 1993).

It is stated by Gutchess and Indeck, (2009) that processing of memory is also different in different cultures. In regard to this, Americans and East Asian adolescents differ in respect of free recall of social interactions. Further, the authors have also stated that Americans can remember more information regarding the central character in terms of videos or narratives, compared to Taiwanese adolescents. The authors have further emphasised that cultural differences in terms of social contexts also affect the emotional judgement and learning of the adolescents.

Assessment is important in determining adolescents' growth and their level of skill acquisition, which is referred to as a formal attempt to determine status of the adolescents' progress with respect to educational dimensions of interest. There are varied reasons for why it is important for teachers to know ways to assess adolescents, both for conventional reasons and contemporary reasons. The conventional reasons are to assess strengths and weaknesses, evaluate adolescents' growth, allocate grades and validate instructional effectiveness. Contemporary reasons are that test outcomes determine public perspectives of educational effectiveness, the performance of adolescents are a part of a procedure for assessing teachers, and evaluation devices can establish instructional quality. In accomplishing varied assessments to test adolescents' performance, memory plays an important role which clearly

indicates the vitality of applying appropriate memory strategies to speed up the learning and development process of adolescents (Alnhadi, 2014).

Standardised tests have been identified as a common way of assessment used in the Kingdom of Saudi Arabia. Standardised tests commonly test either adolescents' achievements or adolescents' aptitude. Teachers usually differ in their knowledge and potential concerning memory development strategies and designing of tools to evaluate their adolescents, which generates the need for standardised tests as a uniform reference. It is also reported by the teachers of Saudi Arabia that they do not possess the required skills, knowledge and confidence concerning the utilisation of varied assessment techniques in the classroom. They also feel that most of the young adolescents face memory-related issues which hamper their academic performance and subsequent career progression (Alnhadi, 2014). Thus, it is important for educators in Saudi Arabia to search for influential memory strategies and strive for expanding their professional knowledge base to foster the career development of adolescents.

In alignment with Hofstede's theory of culture, it has been identified that America is influenced by an individualistic culture that leads to maximising or serving and focusing only on individual interests. On the other hand, Taiwan has adopted a collectivist cultural aspect that leads to fostering a strong relationship with society in which all the people are taking responsibility to work in a group as it also helps to develop effective decision-making (Hofstede's Insight, 2019). In this regard, it has been analysed that in Taiwan, memory strategies are used to enhance all groups of adolescents as there is an effective relationship between the learners and educators. However, in America, a memory strategy is used only for improving the memory level of a particular group, such as college adolescents, and hence, this can be negatively affected. As mentioned, the focus of this study is on Saudi Arabia and

the use of memory strategies to enhance learning in this particular context, which may be significantly different from these previous studies.

1.10 Aims of the study

Memory strategy as a learning technique needs a more thorough investigation to understand its impact on adolescents in Saudi Arabia. This study is considered an important stage in research on the use of memory strategies among adolescents in Saudi Arabian middle schools. The main aim of this study is to identify the effects of memory strategies on intermediate school adolescents in KSA.

Four studies were conducted to gather clarification regarding effective strategies for adolescents in Saudi Arabia. Each study contains its own aims.

The first study aimed to investigate how adolescents use memory strategies in Saudi Arabian middle schools and whether there is a relationship between adolescents' grades and the strategies adolescents use, to find out which memory strategy is most effective for adolescents in Saudi Arabia in the dependent variable of recall.

The second study also aimed to investigate the role of memory in adolescents' learning and the effectiveness of memory strategies based on teachers' opinions. Therefore, the aim of the second study was to evaluate whether the types of memory strategies that adolescents use are related to their academic performance in Saudi Arabia, as measured by their test grades.

The third study was aimed at identifying the memory strategy in order to identify the effectiveness of the memory strategies used by 42 undergraduates that have an average of 19.45 years.

The aim of the fourth study is to analyse the importance of memory strategies among 120 adolescents that are selected from the schools present in KSA and are in the range of 14-17 years.

The following points summarise the aims of the studies included in this report:

Study 1

1. To investigate relationship between adolescents' grades and the strategies used by the adolescents.
2. To investigate how adolescents memorise schoolwork and their opinions about which strategies they think are most effective.

Study 2

1. (1) Which type of memory strategies are used by the student?
2. (2) Whether there is a relationship between adolescents' grades and the type of strategies that adolescents use?
3. (3) What benefits are perceived by the adolescents regarding their memory strategies?
4. (4) What is the importance of memory strategies among adolescents?

Study 3

1. To identify memory strategies and evaluate their effectiveness

Study 4

1. To analyse the importance of memory strategies among adolescents

1.11 Importance and originality of the research

There are very few studies of memory strategy use in Saudi Arabian schools, yet understanding how knowledge can be retained is of great benefit to both teachers and

adolescents. Use of memory strategies could allow adolescents to increase their chances of passing their exams each year and progressing to a higher level. This would give them a greater sense of achievement, and would also help the teachers, as it could improve their success rates. The study also contributes to knowledge about adolescent memory strategy use, as different contexts need to be studied, and Saudi adolescents may benefit from strategies that vary from the ones used by other ethnic groups. It will contribute to Saudi Arabian educational psychology by providing further information on the most successful strategies used by young Saudis. Additionally, it will provide recommendations for adolescents on how to approach examination preparation which will increase their academic achievement rates and consequently benefit the knowledge community that Saudi Arabia is developing.

Among adolescents, both college and secondary school students, the biggest weakness evident among such adolescents is that either they emphasise remembering academic material via rote memorisation or they do not have any strategy at all. Even the adolescents, who utilise rote memory, generally lack a requisite strategy for memorising, depending on varying degrees of casually looking over the curriculum material until they perceive they can memorise it. Experiments reveal that adolescents often over-estimate how much they remember while underestimating the value of future study. Apart from this, many educators working at varying levels have important concern for memorisation, indicating that the focus of the education system should be on teaching and preparing adolescents to think and resolve problems (Hoque, 2018).

Strategies can be used by parents, teachers or adolescents themselves. Teachers making use of memory strategies will develop the potential to differ their presentations so that they use different types of teaching styles. Since every student learns best in his or her most comfortable way, when information is presented in different formats, the instructor raises the chances of approaching a larger proportion of adolescents in a lecture. Parents can

also embrace strategies while helping adolescents in completing assigned homework or assignments. This has an additional advantage of modelling good learning, development and studying styles that a student can use in an independent manner at any later point, thus facilitating the long-term development of adolescents (Alloway & Alloway, 2014).

An ultimate target for adolescents is to design an automatic strategy use, as this raises efficacy when learning and studying. At an initial level, certain strategies can consume more time but eventually they will feel that the usage of strategies provokes their capability of organising and retrieving the information, leading to increased learning efficiency. Time is always limited for adolescents and they might be hesitant in devoting any extra time to memorising strategies. However, a large number of strategies use a technique named as mnemonics that are basically memory tools. Mnemonics can assist in capturing information for retrieving later as they support adolescents in forming a pattern (Gathercole & Alloway, 2008).

Enhancing memory can aid adolescents in performing well in academic and different extra-curricular and co-curricular activities. Different strategies can be considered for improving adolescents' long-term and short-term memory. Continually exercising the brain stimulates innovation and enables the adolescents in exploring and evaluating their boundaries for improved academic outcomes. In order to enrich memory, it is important to make sure that adolescents do not perceive education as a burden, rather they should acknowledge it as an opportunity for exploring a range of new things (Jensen, 2005). Therefore, to escalate the learning pace of adolescents, it is important for educational practitioners to focus on determining the weaknesses of every individual and accordingly detecting the attributes of memory strategies that can help in overcoming such weaknesses and thus enrich their learning potential. The next chapter presents a study carried out in Saudi Arabian middle schools and explores their use of memory strategies for learning.

Chapter Two

Study 1: The use of memory strategies among adolescents in Saudi Arabian middle schools

2.1 Introduction

This chapter presents the first study that was carried out in Saudi middle schools. The aim of this study was to explore the type of memory strategies, which adolescents use to prepare for their final exams, based on the student's opinion of the use and effectiveness. Also, the study further explores whether there is a relationship between the type of memory strategies that the adolescents use and the student's grades at the end of the school year, to determine the effectiveness of memory strategies for adolescents in Saudi Arabia. Professionals such as teachers often face significant challenges relating to effectiveness and impact in determining the most beneficial strategies for adolescents and identifying the memory strategies that are most helpful in increasing the efficacy of adolescents. It is implied from the existing literature that memory plays an important role in improving learning; memory strategies are widely discussed and utilised for improving learning among adolescents (McKnight *et al.* 2016). For the purpose of this study, a correlation test has been used for effectively answering the research question which is stated as: *"is there a relationship between adolescents' grades and the type of strategies adolescents use?"* SPSS software has been used for the calculation of inferential statistics. The comparison of the mean values of the memory strategies and courses was carried out with the use of descriptive statistics.

2.1.1 Research aims

The following research questions were investigated:

(1) Which type of memory strategies are used by the student?

(2) Whether there is a relationship between adolescents' grades and the type of strategies that adolescents use?

(3) What benefits are perceived by the adolescents regarding their memory strategies?

(4) What is the importance of memory strategies among adolescents?

2.2 Method

2.2.1 Participants

Two hundred and twenty adolescents from the third graders of middle schools in Gizan, Saudi Arabia, were selected to complete the questionnaire. The sample for the study included boys and girls, and the researcher worked with the Ministry of Education to determine the number of schools there were in the city, and then selected the schools. Data was collected from 5 male schools who had male teachers and 5 female schools who had female teachers. Stratified random sampling was used to select the samples from those schools based on school numbers. A total of 175 adolescents completed the questionnaire, comprising 88 girls (50.2%) and 87 boys (49.7%). In total 220 adolescents were approached for the survey, out of which only 175 adolescents completed the questionnaire, while 45 adolescents did not complete the questionnaire. Therefore, incomplete questionnaires have been excluded from the study when analysing and deriving the results. The mean age for participants was 15.46 years old (Standard Deviation 0.72, N = 175, Range 14-17 years).

2.2.2 Materials

A questionnaire which contained 18 questions was used to collect data from adolescents. The demographic questionnaire asked about student age and gender and other questions related to the memory strategies used by the adolescents and the techniques used by the adolescents for remembering different subjects. The questionnaire was prepared to

determine the type of memory techniques preferred by adolescents and their opinion regarding use of specific memory techniques. Adolescents were also asked to select from different memory strategies used by them in an exam, including practising words or verses, self-testing, book reading, using rhymes, using pictures, using stories and repetition of words or verses. In addition, adolescents were asked to rate learning techniques preferred by them, their usefulness along with effectiveness of different memory techniques in improving learning of different subjects. The questionnaire (see appendix of study2) was designed for meeting the aims of the study in understanding the way adolescents use memory strategies, along with examining the relationship between grades of adolescents and types of strategies used by the adolescents. The questionnaire was designed for determining the most useful and effective memory strategies. Overall, the questionnaire was developed in alignment with the purpose of the study and investigating the usefulness of memory strategies among middle school adolescents in the Kingdom of Saudi Arabia (KSA). The standardised test used in KSA is a standardised test which contains questions that are to be answered by each individual. All the students had to answer same questions and then the grades were obtained for entire year.

This questionnaire was sent to specialists in developmental psychology at Gizan University and to some teachers who had extensive experience in teaching, to ensure that the questions were suitable for the stage. The outcome of distributing the questionnaire to specialists and teachers was that it helped in ensuring the correctness of the questions for the particular study. In addition to this, it also helped in editing the previous questionnaire with some more relevant questions suggested by the specialists and teachers. The grades of adolescents were used as effective measures for determining the effectiveness of the specific memory strategies of the adolescents. The teachers prepared the room, questionnaires, and

pens for the participants. All materials were prepared in English, translated and back-translated into Arabic for use in Saudi Arabia by the researcher.

2.2.3 Procedure

The participants were selected from10 middle schools, including 5 female schools and 5 male schools in Gizan. The teachers were contacted using video teleconferencing so that they understood exactly how to explain the study's aims. A training workshop for both male and female teachers was then carried out so that they knew how to distribute and collect the questionnaires. Video teleconferencing was used to carry out a training workshop for both male and female teachers. The researcher spent the first week explaining the aims of the study to principals, teachers, and adolescents.The girl's school had female teachers and the boy's school had male teachers.Furthermore, the researcher explained the questionnaire instructions to teachers who were to apply these in schools. In order to develop the questionnaire, first of all, it was decided that the information about the memory strategy used by the adolescents were required, the target respondents were selected and then the questions were selected for a meaningful form. Experts reviews were taken in order to ensure that the questions developed were appropriate. The experts were specialist in developmental psychology at Gizan University and some other experienced teachers. The questionnaire was reviewed by experts to check if the questions in the questionnaire were suitable for adolescents or not. For the girls' schools, the researcher had a meeting with the principal and the teachers to explain all of the instructions. Different setting was used for receiving responses in the girls' school, so that they could present their viewpoints clearly with ease and without any hesitation. It is evident that students are more comfortable in providing their views to an independent researcher as it maintains their confidentiality, however, female adolescents are more comfortable with presenting their views to someone they already know, therefore, their own teachers were assigned for conducting the survey.

Further, there were some cultural barriers and restrictions in the process as adolescents from diverse cultural backgrounds were involved in the process. The teachers also faced difficulties in gathering the questionnaire because some of the adolescents were more hesitant to discuss their memory strategies in the presence of adolescents from different cultural backgrounds. The cultural restrictions also hindered the process of gathering data from female adolescents by the male researcher. The questionnaire was administered in schools by teachers in a separate classroom. After receiving the consent sheet papers from parents, adolescents, and principals during the second week, the researcher determined that the data collection would start on Sunday 14 May 2017 at 9:00 AM for the boys' schools and Sunday 21 May 2017 at 9:00 AM for the girls' schools. At 11:00 am, all the participants at the boys' schools completed the questionnaire and the data was collected the same day. For the girls' schools, the data was collected the next day and adequate time was given to participants in the girls' school for completing the questionnaire. The researcher was directly involved with participants in the boys' schools while teachers were involved in the girls' school; therefore, the questionnaire was collected the next day after distribution in the girls' school due to the indirect involvement of the researcher. Due to cultural issues, there were difficulties in administering the questionnaires to female adolescents and female adolescents may be more comfortable with their teachers than someone they do not know; therefore, the teachers themselves were used as gatekeepers. Further, cultural restrictions also affected the level of hesitation of the female adolescents in discussing their answers with the male researcher. The school grades were obtained through a standardised test for ascertaining the scores of the student in each subject. These grades are collected for the entire year and measured with the use of descriptive statistics. Standardised tests in KSA are known to be standardised as the content, language, scoring procedures and format is same for all the students and thus it provides a way to analyse the individual differences in a very clear way.

2.2.4 Ethical issues

Safeguarding identities of participants, ensuring safety of participants and keeping the acquired data secure are some of the prominent ethical concerns which have been considered in the process of data collection in this research work. Ethical issues are commonly faced in protecting identities of participants, but anonymity of participants is ensured via data encryption and coding schemes. Other than this, the researcher encountered challenges in convincing participants to take part in the data collection process. Prior permission was obtained from participants through consent forms to eliminate any sort of ethical violation in the research process.

2.3 Results

Data were analysed using descriptive statistics to provide information about the sample size, means, and standard deviation. A correlation test was used to answer the question: is there a relationship between adolescents' grades and the type of strategies adolescents use? SPSS software was used to calculate inferential statistics. In order to describe the distribution of these courses, descriptive statistics were used to compare means between these courses and memory strategies.

Age-Group and Grades Statistics

Table 2.2 *Marks, standard deviation of all subjects for sample size175.*

Score for each subject	Marks (out of 50)	Std. Dev.	Confidence intervals 95%	
			Lower	Upper
Score: Quran	22.46	2.51	22.09	22.84

Score: English	36.08	10.05	34.59	37.59
Score: Arabic	40.36	8.41	39.11	41.62
Score: Maths/science	35.40	9.26	34.02	36.78

Table 2.2 shows the descriptive statistics for the adolescents' age and grades in four subjects, including Quran, Arabic language, English language, and math and sciences. The average score in math was 35.4 (SD=9.26), Arabic language was 40.36 (SD= 8.41), English language was 36.09 (SD= 10.05), and the Holy Quran was 22.47 (SD= 2. 51). In the study, the dependent variables measured comprised the scores in mathematics, Arabic language, English language, and the Holy Quran. Achievement in these courses was measured using a standardised test with a continuous score. Independent variables were memory strategies (loci, organisation, practice, narrative, rehearsal, visual and rhyme strategies).

Analysis of the Memory Strategies used in Intermediate School Adolescents in KSA

In order to collect the primary data from the adolescents, the questions posed in the questionnaire were kept simple and direct, aimed at investigating the type of memory strategy most frequently used by them. In this relation, as shown in Figure 2.1, the four most frequently used strategies were used by more than 50% of the sample. The most used strategies were self-test (86.8% of adolescents), mental practice (82.3%), written rehearsal (76.6%) and practice aloud (60%). However, there are other different types of strategies also utilised by adolescents in intermediate school adolescents in the KSA as ways in which they can raise their memory level. For example, the use of strategies including rhyme, mental

imagination, visual, organisation, chunking, clustering, narrative and loci are found to be used by adolescents as other prominent memory strategies. It is observed that loci method is used by a lot of adolescents and the main reason behind this would be that is the best method for supporting declarative memory and recollection of facts and list of items; however, this method is not used much in schools, but the students use it by themselves as it is very effective. The method of loci is very good for supporting declarative memory explicit recollection of facts, lists of items, or other structured data.

Based on an analysis of the distinct views of the adolescents, it was found that adolescents in KSA middle schools are using distinct memory strategies to increase their memory level and thus enable greater participation in school activities.

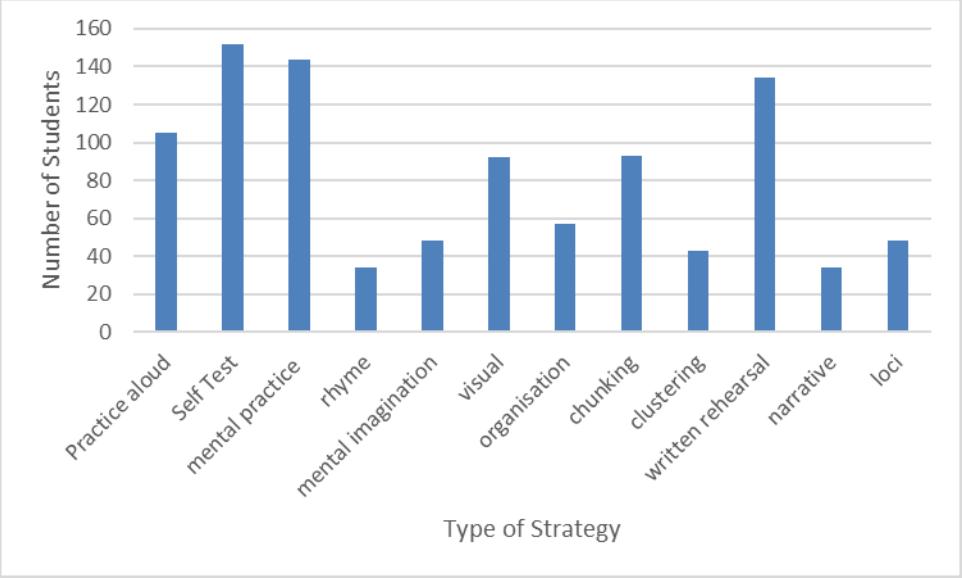


Figure 2.1: Most frequently used strategies by the adolescents

To gain more insight into the memory strategies used by the adolescents, a question linked to frequency of using the strategies across their distinct subjects was asked. The multiple views of the participants were gathered into two key variables, and categorised as same and different. In this context, it was found and shown in Figure 2.2 that117 students used the same strategy with all subjects, including the Quran, English, Arabic poetry and

Maths, whereas, on the other hand, 58 students of adolescents used more than one strategy or different strategies with all subjects. The analysis and interpretation of the multiple views of the participants (KSA's school adolescents) found that the majority of the adolescents were using the same memory strategy for all subjects, and only a few of the total adolescents were using different strategies across the different subjects. This reveals that adolescents have a positive outlook towards using different memory strategies across the same subjects.

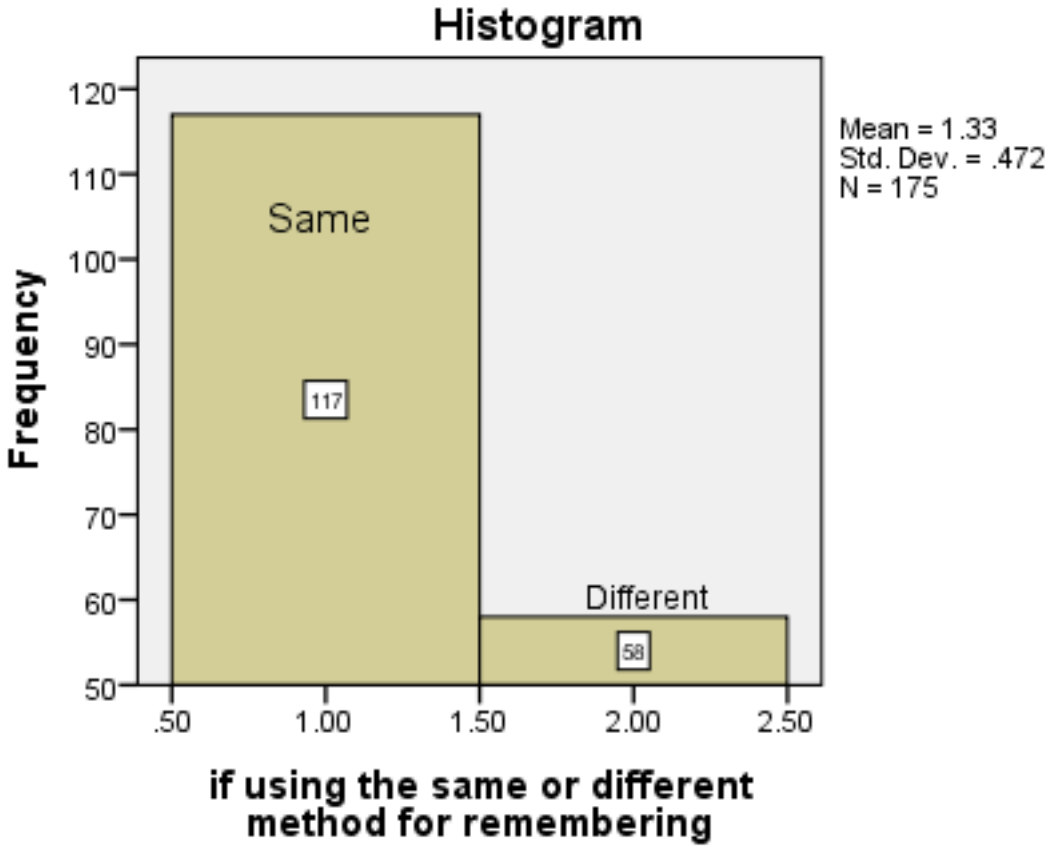


Figure 2.2: Frequency of using a strategy across subjects

After gaining insight into the different strategies used by the adolescents in the schools of KSA, the adolescents were asked to provide their views on the number of strategies used for increasing their memory in different subjects. The varying views of the adolescents were collected and divided into two options, namely More than 1 strategy which was labelled as yes and only one strategy was labelled as no. Based on the views collected,

Figure 2.3 shows that 105 adolescents (60%) used more than one strategy at the same time and 70 adolescents (40%) used only one strategy at the same time. Analysis of the distinct views of the adolescents has revealed that the majority of adolescents are using more than one strategy to increase learning and overall performance. This highlights that adolescents agree to the role of memory strategies as long as they are perceived to be effective.

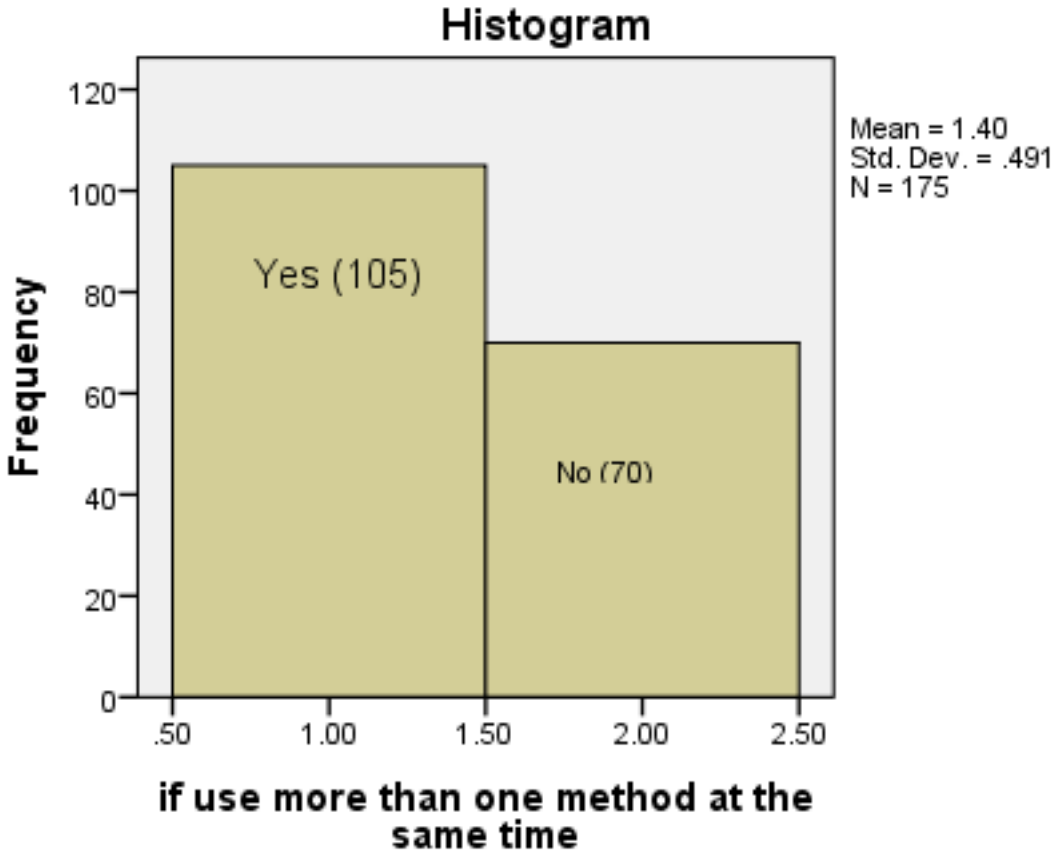


Figure 2.3: Number of Strategies used by the Adolescents

Perceived Benefits of the Memory Strategies used by the Adolescents

Figure 2.4 results indicate that 118 participants (67.4%) believed that some memory strategies are easier than others and 57 participants (33%) believed that there was no difference in challenge between these strategies.

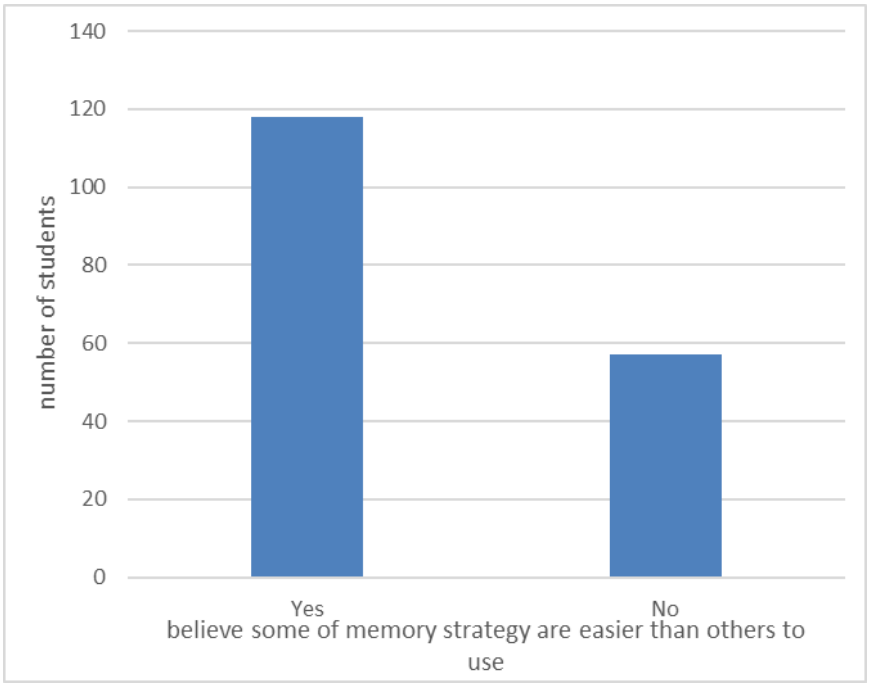


Figure 2.4: Level of difficulty of memory Strategy

It is also evident from Figure 2.4 that the use of cognitive memory strategies adopted by teachers for enhancing the performance of adolescents in the Kingdom of Saudi Arabia is considered as highly effective for deriving better results. On the other hand, the use of multi-sensory strategies, visual images, retrieval practices and handouts are also considered as highly important and relevant for making improvements in the performance of adolescents, by bridging the knowledge and information gap. In this aspect, it is evident from the above figure that some memory strategies are easy to be used by teachers and help in deriving effective results but some memory strategies are highly challenging tasks to be implemented as either the teacher cannot deliver the strategy effectively, or else adolescents fail to understand those strategies.

Figure 2.5 shows that the majority of adolescents reported that they knew how to successfully use memory strategies.

Figure 2.5: Feeling of success when using Memory Strategy

Figure 2.6 shows that the majority of adolescents believed that using memory strategies is beneficial.

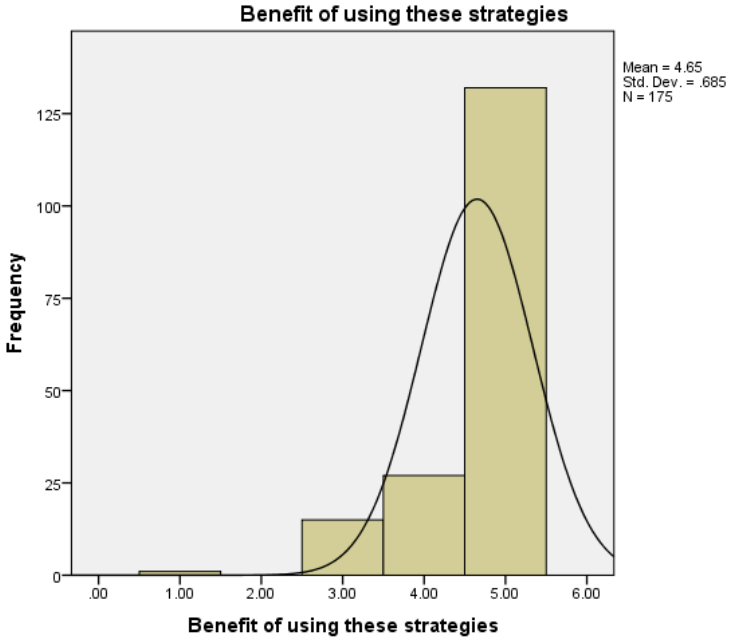


Figure 2.6: Benefit of using Memory Strategies

Correlation of Student Perceived benefit from the Strategy and formal test score

Table 2.3

Correlations

			students score in Quran	students score in English	students score in Arabic poetry	students Maths or Science	Benefit of using these strategies	Feeling successes when using these strategies
Spearman's rho	students score in Quran	Correlation Coefficient						
		Sig. (2-tailed)						
	students score in English	Correlation Coefficient	.143					
		Sig. (2-tailed)	.060					
	students score in Arabic poetry	Correlation Coefficient	.463**	.408**				
		Sig. (2-tailed)	.000	.000				
	students in Maths or Science	Correlation Coefficient	.247**	.576**	.749**			
		Sig. (2-tailed)	.001	.000	.000			
	Benefit of using these strategies	Correlation Coefficient	.000	.258**	.046	.229**		
		Sig. (2-tailed)	.996	.001	.543	.002		

	Feeling successes when using these strategies	Correlation Coefficient	.147	.130	.071	.072	.435**
		Sig. (2-tailed)	.053	.087	.354	.344	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2.3 shows that Spearman's Rho correlation a significant relationship between adolescents' perceived benefits from the strategies they used and formal test scores in English ($\rho(175) = 0.26$, $p < 0.01$) and maths ($\rho\ (175) = 0.23$, $p < 0.01$).

Correlation of student's grades and the number of strategies used by the Student

Table 2.4

Correlations

			students score in Quran	students score in Arabic poetry	students score in English	Sstudents in Maths or Science	number of techniques always use	Number of techniques sometime use	Number of techniques never use
Spearman's rho	students score in Quran	Correlation Coefficient	1.000	.463**	.143	.247**	-.027	-.216**	.164*
		Sig. (2-tailed)	.	.000	.060	.001	.720	.004	.030

students score in Arabic poetry	Correlation Coefficient	.463**	1.000	.408**	.749**	.179*	-.252**	.079
	Sig. (2-tailed)	.000	.	.000	.000	.018	.001	.300
students score in English	Correlation Coefficient	.143	.408**	1.000	.576**	.128	-.017	-.048
	Sig. (2-tailed)	.060	.000	.	.000	.092	.825	.530
students in Maths or Science	Correlation Coefficient	.247**	.749**	.576**	1.000	.210**	-.174*	.017
	Sig. (2-tailed)	.001	.000	.000	.	.005	.021	.819
number of techniques always use	Correlation Coefficient	-.027	.179*	.128	.210**	1.000	-.321**	-.550**
	Sig. (2-tailed)	.720	.018	.092	.005	.	.000	.000
Number of techniques sometime use	Correlation Coefficient	-.216**	-.252**	-.017	-.174*	-.321**	1.000	-.525**
	Sig. (2-tailed)	.004	.001	.825	.021	.000	.	.000
Number of techniques never use	Correlation Coefficient	.164*	.079	-.048	.017	-.550**	-.525**	1.000
	Sig. (2-tailed)	.030	.300	.530	.819	.000	.000	.

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2.4 shows that the relationship between a student's grades and the number of strategies that the student used. Spearman's Rho correlation test showed a significant relationship between the number of strategies adolescents always used and the formal test scores in Arabic language (ρ (175) = .179, $p< 0.05$) and maths(ρ (175) = , 210, $p<0.01$).Also, the results indicated a negative significance between the number of strategies adolescents sometimes used and the formal test scores in the Quran (ρ(175) = -.216, $p< 0.01$) and Arabic (ρ = (175) = -.252, $p< 0.01$), and Maths(ρ = (175) = - .174, $p< 0.05$).

Scatterplot of Relationship in the Scores achieved by the Adolescents in Different Subjects

Figure 2.7 represents the relation between the score of adolescents in different subjects. The first figure reflects that there is a positive significant relation between the score of adolescents in Quran and Arabic poetry. There is a less significant relation between the score of adolescents in English and Arabic Poetry and a negative significant correlation between the score of adolescents in English and Quran; there is a less negative significant correlation between the score of adolescents in English and subjects like Maths or Science. A less significant relation between the score of adolescents in Arabic poetry and Maths or science is also evident and a highly negative significant relation between Quran and Maths or Science.

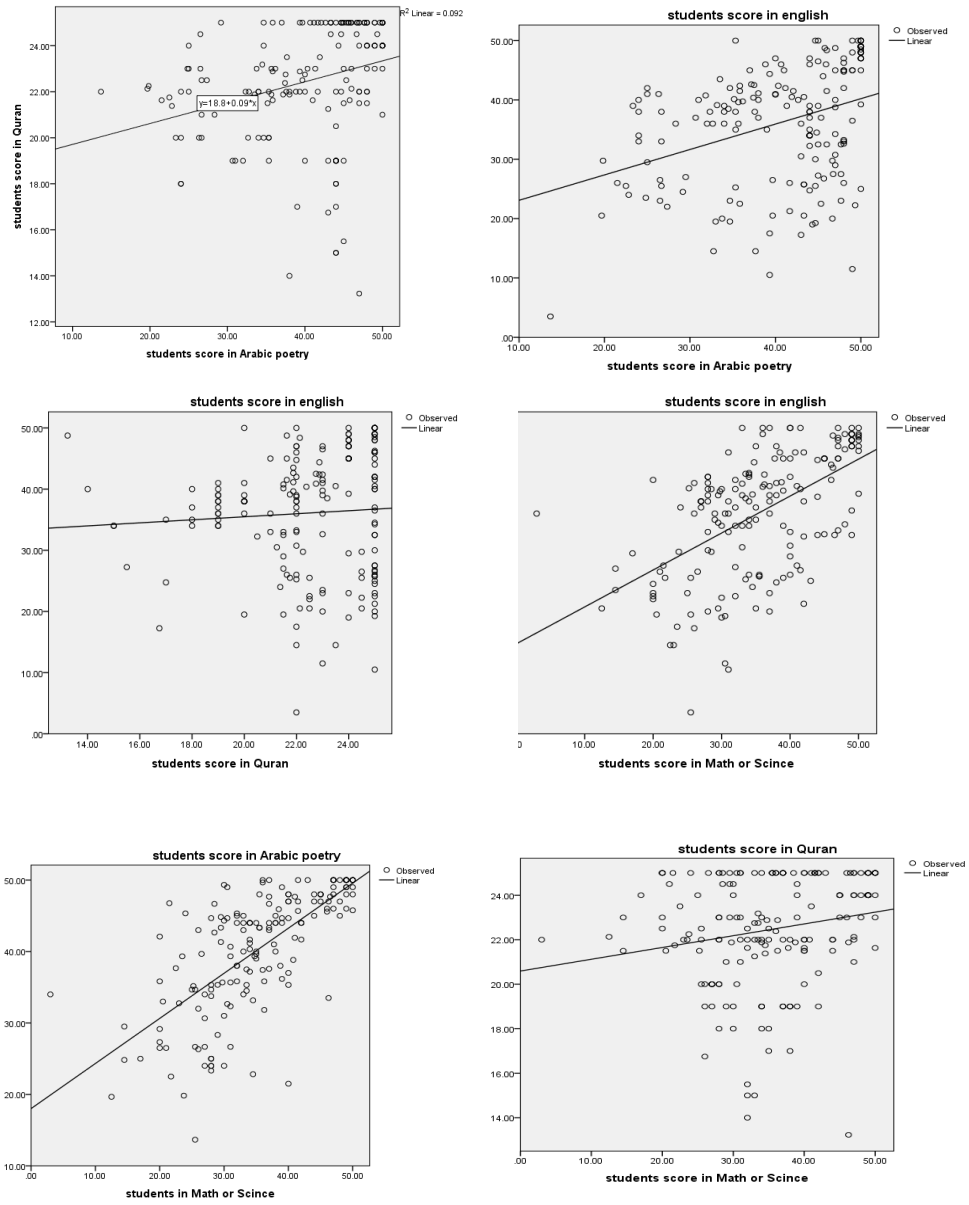


Figure 2.7: Relationship between the Score of adolescents in Different subjects

Correlation in Type of Memory Strategy and Adolescents Grade

Table 2.5

students in Maths or Science	students score in English	students score in Arabic poetry	students score in Quran		
.118	.027	.217**	.170*	Correlation Coefficient	Mental practice
.121	.726	.004	.024	Sig. (2-tailed)	
.-005	.-117	.-083	.-056	Correlation Coefficient	rhyme strategy
.951	.124	.273	.465	Sig. (2-tailed)	
.070	.078	.-154*	.-232**	Correlation Coefficient	Mental Imagination
.357	.304	.042	.002	Sig. (2-tailed)	
.149*	.216**	.168*	.-021	Correlation Coefficient	Visual
.048	.004	.026	.778	Sig. (2-tailed)	
.063	.082	.-032	.-016	Correlation Coefficient	Organization

.411	.283	.670	.829	Sig. (2-tailed)	
.334**	.233**	.278**	.-004	Correlation Coefficient	Chunking
.000	.002	.000	.953	Sig. (2-tailed)	
.106	.063	.026	.-039	Correlation Coefficient	Clustering
.164	.407	.736	.610	Sig. (2-tailed)	
.171*	.172*	.157*	.-023	Correlation Coefficient	written rehearsal
.024	.023	.038	.760	Sig. (2-tailed)	
.-065	.-030	.-197**	.-277**	Correlation Coefficient	narrative
.390	.694	.009	.000	Sig. (2-tailed)	
.-040	.014	.-090	.-137	Correlation Coefficient	loci strategy
.600	.856	.234	.070	Sig. (2-tailed)	
.232**	.034	.310**	.108	Correlation Coefficient	self-testing
.002	.651	.000	.156	Sig. (2-tailed)	
.-006	.-143	.-062	.-073	Correlation Coefficient	practice aloud
.934	.059	.412	.339	Sig. (2-tailed)	
175	175	175	175	N	

Table 2.5 shows that the relationship between a student's grades and the types of memory strategies adolescents used. Spearman's Rho correlation test showed a significant relationship between the mental practice strategy and a student's grades in Quran *(*ρ= (175) =, 170, *p* <0.05*)*, and in Arabic *(*ρ= (175) = .217, *p* = <0.01*)*. For the mental imagination strategy, the correlation test indicated that there is a negative significant relationship in Quran *(*ρ= (175) = -.232, *p* = <0.01*)* and Arabic *(*ρ= (175) = -. 154, *p* <0.05*)*.There is a negative correlation between mental imagery and the narrative as the correlation coefficient is negative. Narrative is a written account of the events, whereas, mental imagination is just a mental picture that an individual creates. It showed a significant relationship between the visual strategy and the adolescents' grades in some courses, such as Arabic language *(*ρ= (175) = .168, *p* <0.05*)*, English Language *(*ρ= (175) = .216, *p* <0.01*)* and Maths *(*ρ= (175) = .149, *p* <0.05*)*. For chunking as a strategy for sorting information, the correlation test showed a significant relationship between using this strategy and adolescents' grades in Arabic *(*ρ= (175) = .278, *p* <0.01*)*, English language *(*ρ= (175) = .233, *p* <0.01*)* and Maths and Science *(*ρ= (175) = .334, *p*<0.01*)*. For the written rehearsal strategy, the correlation test indicated that there is a significant relationship between this strategy and the adolescents grades in Arabic language *(*ρ= (175) = .157, *p* <0.05), English language *(*ρ= (175) = .172, *p*<0.05) and Maths and Science *(*ρ= (175) = .171, *p*<0.05*)*. Narrative as a strategy for sorting information showed a negative significant relationship in Quran *(*ρ= (175) = - .277, *p*< 0.01*)* and in Arabic language *(*ρ= (175) = -.197, *p*< 0.01*)*. Self- test strategy is one of the most popular strategies used in Saudi schools, and the results indicated that there is a significant relationship between using this strategy and the adolescents grades in Arabic language *(*ρ= (175) = .310, *p*< 0.01*)* and Maths and Science *(* ρ= (175) = *.232*, *p*< 0.01

Results of Regression Analysis: Adolescents Score in English, Feeling Successful when using these methods and benefits of using these methods.

Table 2.6

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.264[a]	.070	.059	9.75053
a. Predictors: (Constant), feeling successed when using these methods, benefit of using these methods				

Table 2.6 indicates that a multiple regression was performed to analyse the impact of benefits of using different strategies for and feeling success when using these different strategies on score of English.

Table 2.7

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1223.674	2	611.837	6.435	.002[b]
	Residual	16352.512	172	95.073		
	Total	17576.185	174			
a. Dependent Variable: students score in English						
b. Predictors: (Constant), feeling successed when using these methods, benefit of using these methods						

In this test the p value of regression is 0.02 which is less than 0.05 this indicates that the test is statistically significant.

Table 2.8

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	41.664	1.911		21.803	.000
	benefit of using these methods	-3.620	1.222	-.247	-2.963	.003
	feeling successful when using these methods	-.412	1.047	-.033	-.393	.695
a. Dependent Variable: students scoure in English						

Table 2.8 shows that when multiple regression has been applied, the independent variables are benefits of using these methods and feeling successful when using these methods. The dependent variable is score of students in English. The variable benefits of using these methods is statistically significant as its p value = 0.03. The regression coefficient (B= -3.62) indicates a negative relation between score of English and benefits of using these methods. The other independent variable feeling successes when using these methods is not statistically significant as p value= 0.695 which is greater than 0.05.

2.4. Discussion

2.4.1. Summary of Main Findings

The aim of the study was to examine the student's perspective regarding the type of memory strategies beneficial for the adolescents to prepare for their final exams. In this regard, the relationship between memory strategies and academic performance in terms of grades of students in different subjects has been examined to determine the effectiveness of memory strategies for adolescents in Saudi Arabia.

It is found from the findings of the survey that adolescents used self-test and mental practice as memory strategies for enhancing their learning. Adolescents used memory

strategies in the form of written rehearsals, narratives, rhymes, self-test and mental practice in the context of the first research aim. It is inferred from the analysis in regard to the second aim that adolescents' grades and the type of strategies that adolescents use are closely interrelated to each other. It is inferred that grades are calculated through comparing the performance of a student with specified established standards rather than comparing the performance of adolescents with the performance of other adolescents. In this kind of grading method, the instructor or teacher is interested in determining the extent of knowledge of the student in terms of the tasks and ideas. Contrary to this, the instructor in this grading system is less concerned about determining the extent to which other adolescents have knowledge or have mastered a similar domain. It is inferred that the grades of the adolescents are based on the skills and knowledge level possessed by them at the final stage of the course as compared to the level of achievement of adolescents at the initial stage of the course. Therefore, large gains in knowledge are assigned to high grades along with small gains in knowledge which are assigned to low grades. Thus, these criteria for grading are based on knowledge and facts of the adolescents and are considered important in the effectiveness of the use of memory strategies by the adolescents.

2.4.2 Interpretation in relation to previous research

In the education system of Saudi Arabia, testing is considered an essential tool for school achievement and certain subjects are assessed at the end of the semester on the basis of the skills of adolescents at remembering. Hence, it is essential to assess the memory strategies that are required for the adolescents as well as the opinions of the teachers toward these memory strategies and their effectiveness. The results that are obtained from the research study clearly show that the main differences in course achievements are explained by the type of memory strategies used. Even where the teachers had not encouraged the

adolescents to use memory strategies for remembering, these strategies played an important role in determining the adolescent's achievement or learning in these courses.

Returning to this chapter's questions, there is evidence to support the idea that the effect of using memory strategies will help in supporting the learning process of the adolescents, which helps in enhancing their knowledge base (Alghamdi, 2011; Kholi, 2004).The memory strategies assist the adolescents in enhancing the effectiveness of approaches towards learning and storing the information in their long-term memory. Moreover, the strategies enhance the ability of the adolescents to gain understanding and knowledge in different subjects. It has been inferred that the most effective strategies for adolescents including self-testing and practising. The strategy of self-testing helps the adolescents in analysing their knowledge gaps and identifying the areas where they need to focus, which facilitates learning achievements. Moreover, self-testing assists in relating the previous knowledge to the new knowledge and comprehending the old information in a better way (Dehn, 2010). The other memory strategy that is highly effective for the adolescents is practising. In order to move the concepts and information from temporary working memory among adolescents to their long-term memory, it is essential to repeat the concept and learning. The technique of practising assists the adolescents in strengthening the neural network. This helps the adolescents in recalling the concepts and information in an effective manner (McPherson, 2010). These studies show that certain memory strategies have been found to be effective with adolescents. Further studies also point out that memory strategies are frequently used and can be effective as the following examples indicate.

The strategies of practising and self-testing are profoundly effective for learning and remembering certain subjects that require continuous practice in order to store them in long-term memory. Repetition of things, while practising and self-testing, assists in assuring better learning achievements through adequate learning and remembering (Dehn, 2010).

The outcomes of the study also demonstrated that most of the adolescents find self-testing and practising as effective strategies for learning and remembering. It has been analysed on the basis of results that almost 50% of the sample adolescents frequently used four strategies, namely, self-test, mental practice, rehearsal, and self-test. The outcomes of the study show that the majority of adolescents preferred to use self-test and practice strategies to prepare for the final exam. Also, the adolescents mentioned that practising and self-testing strategies are the best for remembering and easy to use. Due to the ease of use and understanding, most of the adolescents preferred self-testing and practising over other memory strategies.

Memory strategies are frequently used in middle schools in Saudi Arabia and adolescents find them to be beneficial. Saudi adolescents were more likely to use self-test and other memory strategies, including mental practice, practice aloud and written rehearsal, than adolescents in other cultures, for example, USA (Karpicke *et al.,* 2009). Also, these strategies are especially good for learning new vocabulary, such as the English language (Schneider *et al.,* 2002). Self-testing helps in improving long-term memory among individuals, and it is considered highly beneficial for language learning and storing core facts, such as dates and events. Moreover, the rehearsal strategy is also effective for learning certain languages, and the same has been indicated in the results obtained from the primary data. The results indicated a specific relationship between the grades of adolescents in the Arabic language and the strategy of rehearsal; these results indicated that the strategy of rehearsal is beneficial in increasing the learning achievements of adolescents in the Arabic language. Moreover, the results indicated a positive relationship between the self-testing strategy and subjects including Mathematics, Science and Arabic, as well as the English language.

The fact that the effect of memory strategies on adolescents' achievement increases as the approaches to learning increase could have importance in future education policies. In

addition to this, the use of mental practice and self-test have been perceived as significant memory strategies which might contribute to the development of future educational policies. This finding shows that it is possible that other factors decrease the effect of memory strategies. Moreover, teachers and parents may be able to work directly on improving children's approaches to learning.

The use of memory strategies has been positive in the studies carried out by researchers. However, there is a lack of studies that focus on the use of different strategies which work best at different times, or the use of a combination of memory strategies which prove more effective for adolescents.

2.4.3 Limitations and Ideas for Future Research

In future research, the participants should be recruited from adolescents from different schools in order to represent the characteristic of the entire population. The ideas and perceptions of the teachers can be included for gaining clarity on the use of different memory strategies. Therefore, the next chapter is based on determining the use of memory strategies by adolescents in the middle schools of Saudi Arabia. The opinion of teachers has been considered vital for determining the use of memory strategies by the adolescent adolescents in Saudi Arabian middle schools.

2.4.4 Conclusion

It can be concluded from the above discussion that memory strategies are highly beneficial in enhancing the learning process among adolescents. Moreover, different types of memory strategies affect the course achievements of adolescents. The study findings reflect that an increase in the student's feeling of success correspondingly increased their English scores. Further, it was also identified from the study findings that use of memory strategies is beneficial to increase the score of adolescents, which was the main purpose of this study. It is

also concluded from the findings that the adolescents make use of mental practice and self-test as the memory strategy and they used it in the form of narratives and written rehearsals. Apart from this, it was also evaluated that the grades of the adolescents and the type of strategy used by them are closely related as it can be seen with the help of table 2.4. The grades of the adolescents are calculated on the basis of specified standards.The next chapter provides more information on memory strategies used by teachers in Saudi Arabian middle schools.

Chapter Three

Study 2: Teachers' opinions about the use of memory strategies by adolescents in Saudi Arabian middle schools.

3.1 Introduction

The purpose of this study was to investigate teachers' opinions about the role of memory in adolescents' learning. It has been observed that adolescents' memory can be enhanced with the use of effective memory strategies which help in improving the learning capability of the student. The use of strategies, such as reading and tests, help in improving existing knowledge levels of adolescents (Shing & Brod, 2016). Teachers' opinions will be helpful in determining the most effective memory strategies for fostering learning among adolescents along with examining the impact of different memory strategies on adolescents' performance and grades. Additionally, teachers spend a significant amount of time with the adolescents during the day so they can present accurate views about the role of memory strategies in learning and recall (Chang, 2015).

This chapter reviews previous studies that have been carried out on the memory strategies used by teachers, before presenting the findings of a study carried out in Saudi Arabia that surveyed 18 teachers in Saudi middle schools. This was to elicit their perceptions on the use of memory strategies that facilitated learning and the effectiveness of such strategies in improving the learning process. However, firstly a review was carried out on other studies that had been conducted with adolescents and the perceived effectiveness of using memory strategies to enhance learning. These papers were selected were selected by using search terms like memory strategies, perception, teachers and effectiveness. All the peer reviewed articles above 2008 were selected in the study so as to gain current knowledge.

3.1.1 Literature Review

A review of the literature was based on specific themes related to the aims of the study. These were to explore what other researchers had found about how teachers perceived the importance of memory strategies and which strategies they encouraged adolescents to use. It was also important to investigate what existing literature had found about the effects of memory strategies on performance of adolescents and in particular what was known about the effects of memory strategies on the performance of Saudi adolescents.

Theme 1: Perception of teachers on the importance of memory strategies for adolescents' learning

According to Rotter (2009), the essence of teaching revolves centrally on creating new memories for adolescents. In this, the teachers play a vital role in assisting adolescents in storing the required information and the way in which adolescents recall and access such information in the future; consequently, this points to the likely outcome of the performance of adolescents. Teachers were found to believe that the use of memory strategies plays a vital role in enhancing the learning of adolescents, as using strategies to manage the seamless supply of information, concepts and skills raises the efficiency of adolescents' learning (Rotter, 2009). In support of this, Van Blenkon (2009) has opined that there are various learning strategies that can be used by teachers to enhance the memory of adolescents. In relation to this, in order to form memories, a three-step process is adopted, namely sensory memory, short-term memory and long-term memory. By undergoing all these processes, strong memories are established. This process assists adolescents to form a new association and explore untapped knowledge areas and has revealed that the use of memory strategies plays a vital role in uplifting the memory level of adolescents, according to teachers. Greater use of memory strategies is perceived by teachers as beneficial, mainly for adolescents facing

barriers to learning as it assists them in improving their recall and memory (Van Blenkon, 2009).

In their detailed elaboration of the importance of memory strategies, Karpicke and Roediger (2008) opined that the effective use of memory strategies positively affects the adolescents' learning. This makes adolescents aware of the processing of information, pedagogy and the most suitable learning and exercise strategies that should be used to foster greater engagement with words. Along with this, memory strategies and exercises help in fostering greater retention of information in adolescents in comparison to less substantial activities. Thus, physical activities were used in order to strengthen the memory of the adolescents (Karpicke and Roediger, 2008). However, in arguing this, the study conducted by Yang and Dai (2012) for examining the use of memory strategies in teaching vocabulary items was carried out using both a delayed and immediate test. The results of the study reiterated the effectiveness of long-term teaching via memory strategies and providing adolescents with the awareness of how to use such strategies. The literature argues that some adolescents were not using the strategies effectively as in adolescents rarely using memorising strategies, (Yang& Dai, 2012).

Ali and Yunus (2013) mentioned that past studies show that the role of effective use of language learning strategies creates significant positive impacts on language learning adolescents. The literature claims that the effective use of the strategies reflects the improved proficiency of adolescents in language, creating a positive impact on memorisation, and establishes the structural association of adolescents with the new words. The strategy used was contemplation in which the adolescents are asked about the things that are already told to them which enhances the memory in them (Ali and Yunus, 2013). In arguing these views, Savage (2018) has opined memory as a superior cognitive process, which explains the temporal dimension of mentality. This reflects the ability of an individual to store, encode,

retain and recall past experiences and information effectively. In this, the use of memory strategies plays a crucial role in reflecting the adolescents' past experiences and offers the possibility of reusing the present and past experiences effectively. It has highlighted memory as the subjective, active and intelligent process of reflection of the adolescents' previous experiences and learning (Savage, 2018). These papers were selected as they clearly discussed regarding the perception of the teachers on the effectiveness of memory strategies for the adolescents. These papers were selected by using the search terms like perception, teachers, effectiveness and memory strategies. Peer-reviewed articles above 2008 were selected.

Theme 2: Memory Strategies Encouraged by Teachers to be used by Adolescents

On the given theme, several studies evidence that different strategies are used by teachers for increasing memory and overall learning of adolescents. In this regard, Banikowski and Mehring (2010) have opined that there are several strategies which can assist teachers to provide connected new learning to adolescents using learners' prior experience and knowledge. Key strategies include brainstorming or sharing that encourage adolescents to bring their knowledge or experience to the learning, and follow the KWL strategy (What I Know, What I Want to Know, What I have Learned) developed by Ogle (1989), wherein the learner is encouraged to bring to the surface their prior knowledge(Banikowski and Mehring, 2010). In addition to this, Van Blenkon (2009) added that strategies of anticipation and the prep teaching technique are also highlighted in the literature. Using the anticipation guide, adolescents are asked to activate their prior knowledge regarding a topic and provide a specific purpose for future learning prior to their engagement in reading or any other information source. On the other hand, the prep teaching technique allows adolescents to take part in group discussions to discuss their existing knowledge of a certain topic, reflect on their initial association and reformulate ideas apart from this, Schneider (2010) added that the

teachers also encourage the students to be involved in physical activities and contemplation as these help the adolescents to actively develop skills like physical education and music and helps to strengthen the memory of the adolescents (Schneider, 2010).

In addition, Van Blenkon (2009) proposed several strategies to encourage the honing of general memory in adolescents. These related to strategies concerning spaced practice, repetition, and breaking tasks down, all of which increased the working memory of adolescents in order to transfer it eventually into long-term memory. This raises the retention of new information among adolescents for the long-term. The literature has put significant emphasis on mnemonic devices and rehearsal techniques. The mnemonic technique is claimed as the technique that allows adolescents to form associations with the learning materials they are using. These are claimed as highly useful for adolescents to remember information which is not well-structured and thus cannot be stored in the long-term memory of adolescents in an effective and organised manner. For this, the use of acronyms, acrostics, and associations all make use of mnemonic devices effectively (Van Blenkon, 2009).Along with this, Camos and Barrouillet (2011) stated that the use of distinct rehearsal strategies can also be used by adolescents. These are divided into two parts, namely, low-level rehearsal strategies and high-level rehearsal strategies. The low-level rehearsal strategies involve repeating the materials a few times, repeating information over and over and copying the actual material given. On the other hand, high-level rehearsal strategies include outlining, predicting test questions, creating charts, self-tests, study sheets, concept maps, and explaining the study material in their own words (Camos & Barrouillet, 2011).

In a similar context to these findings, Rotter (2009) has opined several other teaching strategies that encourage the development and use of memory in children. His study claimed strategy instruction as a useful strategy wherein adolescents are provided with direct instruction, whereas, visual mnemonics encourage adolescents to make use of the visual

depictions of the mnemonic devices, which is found crucial for adolescents with learning differences. A greater focus on the independence of adolescents to make use of the desired memory enhancing strategy is also made in the literature. Reduction mnemonic and student generated mnemonics are also used as prominent strategies by teachers of adolescents. Under reduction mnemonics, the large body of the information is reduced to a shorter form, and every shortened piece is represented by a letter. In contrast to this, the student generated mnemonics strategy encourages adolescents to develop their own devices independently.

However, Ali and Yunus (2013) have found emphasis should be on memory and cognitive strategies. The memory strategy comprises four memory sets that create mental linkage, apply sounds and images, and review the employed actions. Memory strategies support the learning of adolescents to a level wherein the learner will be able to store and retrieve information effectively regarding the language. On the other hand, cognitive strategies make use of four sets of strategies, including practising, receiving and sending, analysing and reasoning, and eventually creating the structure for output and input. This helps in constructing a formal model in the minds of the learner on the basis of the analysis and comparison of the newly available information (Ali and Yunus, 2013).

Furthermore, Thorne (2019) has opined that school-age children demand more memory sharpening requirements in comparison to adults. However, sustaining memories is a complex task as many adolescents are found to register information in a short period of time. They frequently face difficulties in recalling some specific factual information. In order to enhance the memory of adolescents, various strategies are highlighted by the author, such as giving direction to adolescents in multiple formats, over-learning of new information, teaching adolescents to make use of visual images and providing teachers with pre-prepared handouts prior to handling class lectures. Along with this, the strategies pertaining to

providing retrieval practice in adolescents and teaching adolescents to become active learners have been emphasised by the literature (Thorne, 2019).

Theme 3 Extent to which memory strategies affect the performance of adolescents

According to Hamdan & Alharbi (2017), several strategies are adopted by language researchers and teachers for teaching new words and enhancing the memory of adolescents. The use of a semantic mapping strategy has been identified as highly effective in strengthening the memory of adolescents and making significant improvements in their performance. This strategy emphasises making use of vocabulary instruction that supports the development of memory for the long-term and ensures that adolescents can learn and use new vocabulary that is retained in their memory for the long-term (Hamdan & Alharbi, 2017). The use of this strategy is considered highly important for teachers in enhancing the level of adolescents' engagement in practices carried out in class and help children to establish a relationship among different words in an organised and meaningful manner. The semantic mapping strategy integrates practices that increase the knowledge and reading abilities of adolescents, along with the extension of support to adolescents in increasing their memory. Adolescents gain an opportunity to categorise and visualise new words that helps them in the better reading of text along with enhancing their memorisation power. This strategy is considered as highly effective and important for new language learners in enhancing their vocabulary, even for studying complex disciplines including medicine and psychology (Hamdan & Alharbi, 2017).

As stated by Cohen (2012), memory has been identified as an important factor in enhancing learning among human beings, wherein it is evident that some specific experiences stored in the memory influence to a great extent the actions initiated by an individual. The use of effective memory enhancing practices is considered as highly helpful in enhancing the

visual and auditory skills of adolescents, enabling them to read and learn with high efficiency and effectiveness (Cohen, 2012). The application of the information processing theory for enhancing memory by teachers is considered as highly effective in increasing sensory receptiveness, overcoming short term memory loss, developing language skills and increasing long-term memory. The use of integrated memory building strategies and practices are considered as highly effective in the development of mental cognitive abilities including the thinking process, language development, retention of information, and better understanding of different perspectives about the subject under study (Cohen, 2012).

According to Al-Zoubi & Abdel Rahman (2016), the use of memory theories by teachers has delivered constructive results concerning the development of cognitive thinking skills among adolescents. The integration of effective memory development strategies is considered highly effective in making significant improvements in reading, writing and learning skills of adolescents. The use of WM (working memory) theoretical constructs are considered as highly effective in enhancing the cognitive thinking skills of individuals: the presence of a strong relationship has been observed between WM (an intellectual system that supports short-term storage and processing of memory from a review of the external environment) and real-world skills. The memory strategies used by teachers in the classroom supports the development of cognitive skills of critical thinking, language development and understanding. In this respect, the WM theoretical perspectives further support the development of short-term and long-term memory of adolescents, enabling them to perform better (Al-Zoubi& Abdel Rahman, 2016).

In the viewpoints of Chao *et al.* (2013), memory-enhancing practices are considered as highly effective in increasing the level of learning and attentiveness among adolescents. Metacognition practices integrated by the teachers are highly effective, and this is reflected in their work at an individual as well as team level. Metacognition practices focus on the

integration of practices and the selection of strategies that are highly effective in better management and allocation of resources and tasks based on the situations, enabling the student to perform with increased effectiveness (Chao *et al.,* 2013). Such metacognition practices and skills associated with enhancing memory of adolescents are focussed on setting specific learning goals, increasing the awareness level, a proper allocation of time for carrying out studies, selecting appropriate strategies for solving problems and developing learning skills and making necessary changes in the learning strategies if required, enabling adolescents to better monitor, learn, comprehend, and design plans for improving their performance. The memory-building strategies promote the ability for self-control and monitor whether adolescents can retain information, ideas and knowledge with high-level accuracy (Chao *et al*., 2013). The review of the accuracy-influences-memory (AIM) and self-regulation processes employed by the teachers prior, during and after integrating memory-enhancing practices supports adolescents in developing a positive mind set, organising tasks, enhancing the accuracy level and with better retention of valuable information (Chao *et al*., 2013).

Theme 3a Effects of memory strategies on intermediate school adolescents in the Kingdom of Saudi Arabia

According to Gilakjani & Sabouri (2016), the use of memory strategies with intermediate school adolescents in Kingdom of Saudi Arabia has a significant impact on developing their information processing skills, control over attentiveness and eliminating constraints concerned with limitations associated with short-term memory. The memory strategies are considered as highly effective in enhancing the long-term memory of adolescents, enabling adolescents to access information with ease (Gilakjani & Sabouri, 2016). Memory strategies are considered highly effective in activating skills associated with accessing, retention and enhancing of knowledge among students, through developing

automatic processes associated with learning. Memory learning skills are highly effective in making significant improvements in the working memory, with multiple corrections, unfamiliar input, knowledge processing, complex changes, removing learning and processing biases, and integrating grammatical corrections that ultimately extends support to the adolescents at intermediate school level in enhancing their performance (Gilakjani & Sabouri, 2016).

As stated by Pérez & Alvira (2017), the use of pedagogical intervention practices that support the development and enhance the effectiveness of memory of adolescents are considered highly effective in improving grades of adolescents enrolled at the intermediate school level. The use of memory-enhancing strategies, including picture association, word cards, and pictorial presentation of stories are considered as highly supportive for adolescents through the easy acquisition and retention of vocabulary. The use of memory strategies is considered as highly effective in the identification and overcoming of issues/difficulties faced by adolescents in the Kingdom of Saudi Arabia in learning a new language or in English language skills (Pérez & Alvira, 2017). The application of memory strategies has increased the level of awareness among adolescents by increasing their capabilities to make effective use of spacing, cognitive depth, pacing, imagining, mnemonics, and organisation skills. The results of the tests conducted by the Ministry of Education concerning the use and effect of integrating memory strategies by teachers for adolescents enrolled at intermediate school level reflects improvements in the ratings of the adolescents. The use of memory strategies, along with increasing the vocabulary of the adolescents, has enabled adolescents in gaining better retention and retrieval of new words as was evident from the review of results of classroom tests (Pérez & Alvira, 2017).

According to Ahmadi, Ismail & Abdullah (2013), the use of proper memory strategies by teachers has created a positive effect on enhancing the performance, skills and knowledge

level of the adolescents enrolled at intermediate school level in the Kingdom of Saudi Arabia. Memory skills used by the adolescents are considered as highly effective in making improvements in the level of organisation skills, along with the development of new knowledge that ensures adolescents can learn new vocabulary and other skills with high effectiveness and ease (Ahmadi, Ismail & Abdullah, 2013). The reliance on making use of memory strategies has supported teachers in creating a positive environment at the schools that support the development of an effective learning environment and enables adolescents to enhance their thinking and learning skills beyond set limits. Adolescents feel encouraged and motivated to acquire new knowledge and information, provided they feel that the memory strategies selected by teachers are supportive in designing effective learning plans that support their long term development and growth (Ahmadi, Ismail & Abdullah, 2013).

With so many memory strategies proving to be effective for learning, it is difficult for teachers to select which ones will be the most suitable for their own learners. It is important to investigate the strategies perceived as most effective by both learners and teachers as such information will help teachers to make choices about which strategies may be most beneficial for their students.

3.1.2 Research aims

The following research questions aims were investigated:

(1) To what extent do teachers think that memory strategies are important for adolescents' learning?

(2) Which type of memory strategy do the teachers encourage their adolescents to use?

(3) To what extent do memory strategies have an effect on adolescents' performance?

3.2 Method

3.2.1 Participants

The participants were 18 teachers who teach the subjects including the Quran, Arabic Language, Maths and Science and English Language; 10 were from a female school, and 8 from a male school. All participating teachers were from the same schools as those of the adolescents in study 1.

3.2.2 Interviews

The teachers were asked to respond to the following interview schedule:

- How important do you think memory is for adolescents' learning?
- What are the memory strategies that you encourage adolescents to use?
- Do you think these memory strategies are effective?
- Do you think the adolescents use more than one strategy at the same time?
- Why do think the adolescents do that?
- Do you believe these strategies have an effect on adolescents' performance?
- Why do you believe that?
- Do you think those memory strategies are good for recall?
- Why do you think that?
- Do you believe some of the memory strategies are easier than others to use?
- Why do you believe that?

3.3 Procedure

After the researcher received approval letters from the Ministry of Education and received the consent sheet form on 1st June 2017, the interviews were conducted individually by the researcher. Between June and July of 2017, the researcher conducted 18 qualitative

interviews with teachers via phone calls. The interviews took about 15 -30 minutes for each teacher. Through open-ended questioning, participants were asked about the role of memory in adolescents' learning. As the influence and role of memory in adolescents' learning emerged within the first interviews, the research was iteratively adapted in terms of the interview guide to include probes to specifically inquire about the role of memory in adolescents' learning. Given the different experiences that were shared by the diverse sample, some areas were explored in more depth than others during the interviews.

The interviews were carried out by the researcher for all participants. The survey questionnaire was completed by participants after the end of the session. The factor of social norms is the reason behind the interviews being conducted via telephone. Saudi women are banned from meeting face to face with men who are strangers. Also, the regulations in Saudi society do not allow the researcher to meet female teachers in girls' schools. The researcher recorded the responses and transcribed the interviews onto separate papers for each teacher, and then the Arabic transcriptions were translated into the English language. Thematic analysis was used to analyse the teachers' interview responses. In this context, different themes were developed in accordance with the main questions of the research and in alignment with the questions that the teachers were asked. These themes have been considered to be the foundation for the integration of transcripts and responses of the teachers. Thus, keeping in mind the main question of the research and the aims and objectives of the research, various themes were developed in a way that can address all the above-mentioned aspects. Further, the responses of teachers were reviewed and integrated into different themes in a logical manner. This logical grouping and integration of the interview responses was beneficial in terms of obtaining the key findings pertaining to the subject area of the research. Logical grouping can be understood as the grouping of the elements that are similar and contemplate each other.

3.4 Results

This research utilised a mixed method approach to identify the relationship between adolescents' grades and type of strategies adolescents use. The researcher read the interview transcripts several times to identify codes and merge the codes into themes, checking back to the transcripts (Braun & Clarke, 2013). Through analysing the patterns across data for the participants (teachers), four candidate themes were identified: the importance of memory in learning; encouraging adolescents to use the strategies; effective strategies; and if these strategies are good for recall and easy to use. The themes and examples are shown in Table 3.1.

Table 3.1

Example	Code	Theme	Overarching theme
Teacher*: I think memory strategy is very important for the adolescents to recall.* Teacher: *Memory strategy is necessary to recall the information and student's achievement at the end of the school year.*	Very important, helping in remembering, useful in the recall	The importance of memory	The role of memory in adolescents' learning
Teacher*: I always encourage my*	Practice loud, self-	Encourage	The role of

adolescents to use self-test strategy and practice. Teacher: *I encourage my adolescents to use a suitable strategy for the type of information such as visual strategy, organisation strategy.*	test, practice mentally, rhyme, mental imagination, visual, organization, chunking, clustering, rehearsal, narrative, loci	adolescents to use	memory in adolescents' learning
Teacher*: I think these strategies are effective: especially the self-test and organisation strategy.* Teacher: *In my experience, these strategies help adolescents if the adolescents know how to use them.*	Effective for remembering, easy way to help adolescents to save information	Effective strategies	The role of memory in adolescents' learning
Teacher: *I think these strategies have a good effect on the adolescents' performance because these strategies help adolescents recall.*	Excellent for recall Not bad to recall	Good or bad for recall and easy to use.	The role of memory in adolescents' learning

Teacher: *I think some of these strategies are easier than others because the instructions for use are very easy and clear.*	I do not have an idea about this		

Theme 1: Examining the Importance of Memory Strategies

Assigning memory strategies as very important for learning was a common response from teachers. Thirteen teachers believed that memory strategy had an effect on adolescents' learning. These participants reported that memory strategy is very important for a student's learning and helps adolescents remember information when they need it.

Female teacher: "*Memory is an essential thing for the learner, as it is what makes the learner unique and that is because it connects to the skills of the student, for which memory is an important thing and needs concentration while learning".*

Five teachers were confused about memory strategy and learning strategy, so their responses to the remaining questions were different to other teachers. This indicated that they did not have an idea of memory strategy and the role of memory strategy in adolescents' learning. For example, one stated, *I always divide the adolescents into groups and ask them to work together.*

The majority of teachers agreed in their responses that memory strategy plays a major role in adolescents' learning and, according to their responses, student achievement is reported to be one of the factors that can change based on which memory strategy the student used. After further investigation, it was found that these teachers had graduated from the

USA or UK universities, and because of that, they had developed a good vision concerning using memory strategy in learning.

Male Teacher: *"There are classifications for the memory depending on the differences between each individual student, and the importance of memory in memorising the information that the adolescents learn and helping to remember when the student needs it. Also, the talented student selects the best strategy which will help him to save and recall information".*

Theme 2: Encouraging the Adolescents to use Specific Memory Strategy

To encourage adolescents to use memory strategies, most teachers' responses indicated that they always encourage their adolescents to select a suitable strategy based on the subject. For example, if this new information is related to previous information, the teachers always encourage their adolescents to use the organisation memory strategy. On the other hand, if this new information does not have any relation to previous information, the teachers prefer to encourage their adolescents to use a different strategy, such as self-test, rehearsal, and mental practice.

Female teacher: "*Due to the individual differentiation among the adolescents in the subject of memorising, I always try to motivate them to use easier ways to remember and not use a hard, complicated way; this could make remembering for adolescents easier, such as self-test, practice mentally and rehearsal".*

Male teacher: *"The strategies that I motivate my adolescents to use depend on the subject and teaching and that is different from one subject to another, and from this strategy, I make sure my adolescents are learning it, an example of practice, rehearsal and organise".*

Three teachers did not mention this, because they believed that the student will have to decide which type of memory strategy to use. Moreover, they believed that each student

has a private strategy to save information and recall it, and so they do not believe that the student needs someone to support them.

Male teacher: *"I did not do that before because I do not know which strategy the student has used and if the adolescents prefer this strategy or not. Also, the teacher is not responsible for teaching these strategies to adolescents. In my opinion, these strategies grow with the student and the parents and they should learn them".*

Theme 3: Effective Strategies for Improving Memory

Considering an effective strategy, most of the participants, who thought that memory strategy was important for learning, also agreed that memory strategy is effective in increasing student performance. Although five participants were confused about the role of memory strategy in learning, they thought these strategies were more effective for a student's achievement.

Male teacher: *"Yes, it works as the student gains more strength in the memory, which could be in many interesting ways*".

Female teacher:*" hmm, yes I believe it's useful because it without a doubt helps to improve the memory and strengthen it for the student*".

Theme 4: Advantages and Disadvantages of Memory Strategies

The results indicate that all the participants agree that memory strategies are good for recall and that some of those strategies are easy to use. However, the student will only benefit from these strategies if he/she knows how to use them, because some strategies are hard to use and need practice.

Female teacher*: "Yes, if the student practises and works on it the right way and understands the right way of using it".*

Female teacher*: "I don't think that there is a hard and easy strategy because all of them are working together in the learning process. On the other hand, if these strategies are linked in any way that will help the student to remember better than using one strategy, so help him to select the suitable strategy based on the subject".*

Male teacher: *"Yes, there are simple strategies [that] come in a few steps and don't need much effort from the student, such as rehearsal, practising, and there is a complex strategy".*

3.5 Discussion

3.5.1 Summary of primary findings in the light of Literature (Previous findings)

In study 2 the focus has been on examining the opinion or perception of teachers regarding their use of memory strategies and the effectiveness of these strategies in enhancing learning in middle school students. The opinion of teachers regarding the use of memory strategies by adolescents in the middle schools of Saudi Arabia was important and 18 teachers, who were teaching subjects including Arabic language, Maths, Science and Quran were selected to participate in the study. Among the total participants, 10 belonged to the female school, and 8 belonged to the male school, all of them teaching at the same school. In order to validate the data, information from previous studies was analysed in detail under distinct themes designed to achieve the aim of the study. Based on the findings made on analysing primary findings, it was found that memory strategies play a vital role and create a positive impact on student learning. Memory is explained as the essential thing that makes a learner unique and distinct from others and plays a vital role in fostering adolescents' overall performance. In support of this, the literature revealed that the effective use of memorising strategies assisted adolescents in storing the requisite information, gaining better clarity of the concepts and skills and fostering greater retention, in contrast to other activities. Along with this, the effective application of language learning strategies were found to play a crucial role

in reflecting the improved proficiency of adolescents in the language, helping to create a positive impact on memorisation and assist in establishing a structural association with the new words. In this way, on the basis of collecting and comprehending primary and secondary data, the crucial role of memory strategies was perceived by teachers for adolescents in the middle schools of Saudi Arabia.

In order to enhance memory, different strategies are available to adolescents, which tare utilised to enhance the memory of adolescents. Teachers claimed that they always encourage their adolescents to make use of some specific memory strategy. In this regard, an emphasis on organisation memory strategy, and more significantly an emphasis on using memory strategy in alignment with individual needs has been made by the teachers in interviews. The teachers are not in support of using some fixed pattern, a hard or complicated way of memorisation to make the learning of adolescents easier. Indeed, the review of existing sources has revealed a wide range of strategies used by adolescents to increase their memory. Based on these findings, it can be suggested that distinct memory strategies should be used; in this way learners are encouraged to bring their overall experience and knowledge to the surface.

It was found that the literature emphasised encouraging adolescents to develop their own devices independently for increasing their own memory. More specifically, the literature has put significant emphasis on mnemonic devices, rehearsal techniques, mental linkage, applying sounds and images, the prep teaching technique, the KWL strategy, anticipation guide and rehearsal techniques to increase the memory of adolescents. The use of high-level rehearsal strategies include outlining, predicting test questions, creating charts, self-tests, study sheets, concept maps and providing of a comprehensive explanation of the study material in the own words. Along with this, the positive role of the use of acronyms, acrostics, associations and mnemonic devices was also found to enhance the learning of

adolescents and their overall performance. The findings revealed that teachers are using distinct strategies for different adolescents to increase their memory.

The interviews show positive aspects of using memory strategy among adolescents in Saudi Arabian schools. The main strength of this research is the initial randomisation. Although the accessible populations were the third-grade middle school adolescents of Gizan, it could be applied to all middle school adolescents in Saudi Arabia or elsewhere. The teachers at these schools show an awareness of using memory strategies in learning which has increased during recent years, and this goes back to the new generation, who graduated in the USA and UK. The existing literature also suggests that memory strategies are frequently used by the teachers of middle schools in Saudi Arabia to improve the adolescents' performance in recall, especially in some subjects like Arabic, English and the Quran. Saudi teachers were more likely to encourage their adolescents to use some of the strategies such as mental practice, rehearsal, organization, and self-test than those in other cultures, for example, the USA (Karpicke *et al*., 2009).

The findings of Cohen (2012), concerning evaluation of the impact of using memory strategies on enhancing the performance of adolescents in the Kingdom of Saudi Arabia reflects that the use of memory strategies has presented significant improvements in the knowledge level and quality of performance of adolescents. A significant improvement has been addressed in the ability to learn a new language and increase vocabulary, owing to an increase in the retention and recalling strength of the adolescents through the use of memory-building strategies by teachers (Cohen, 2012). Based on the literature findings presented by Hamdan and Alharbi (2017), it can be further shown that the use of visual effects, pictorial storytelling practices and semantic mapping strategies concerned with the development of short-term and long-term memory extended support to adolescents by increasing their ratings and overall performance; this was by ensuring that they could establish a link between new

words and retain them for the long-term along with understanding their meanings so that they could be used effectively. The use of innovative practices and memory enhancement techniques by teachers have developed skills and abilities among adolescents to categories new words and frame sentences, along with developing a visual image that extends major support to them in learning a new language; this extended to learning even complex disciplines concerned with the field of psychology and medicine at high school level and postgraduate level (Hamdan & Alharbi, 2017).

It is further suggested, in the light of the literature review that, based on the past experiences of the students, memories are created that have a significant impact on the decision-making process of the adolescents. Application of appropriate memory development strategies is considered as highly supportive in the development of auditory and visual skills among adolescents, ensuring that adolescents can learn and read with improved efficiency. The use of memory strategies works towards enhancing sensory receptiveness among adolescents wherein they can respond to the situations in lesser time and with higher accuracy. Making improvements in the retention of information and knowledge for the short-term and long-term are highly effective in overcoming the issues pertaining to the loss of memory. Further, the use of memory development strategies is supporting the development of cognitive skills, critical thinking skills, increasing retention power, the development of new language learning practices, and enhancing the level of understanding among adolescents (Al-Zoubi & Abdel Rahman, 2016).

It can be shown from primary data findings that assigning memory strategies is considered as important for learning, according to the teachers. It has been observed that memory strategy had a positive effect on adolescents' learning. It is also reflected from the literature that memory strategy is very important for improving the learning process of adolescents and helps adolescents remember information and apply this knowledge in every

situation (Gilakjani & Sabouri, 2016).Further, the primary data findings also reveal that memory strategy plays a major role in adolescents' learning and student achievement is considered a significant factor that can change and affect the memory of adolescents.

On the basis of data findings, it can be inferred that adolescents can be encouraged to use memory strategies, mostly through the selection of a suitable strategy on the basis of a specific subject. Further, the literature also points out that memory strategy is effective in increasing student performance. Although there is some confusion among the teachers regarding the role of memory strategy in the process of learning, they perceive these strategies as more effective in terms of the achievement of the student (Shing & Brod, 2016). Overall, it is indicated that memory strategies are good for recalling but there must be ease of use of such strategies.

Supporting the primary data findings the review of literature reflects that the use of memory strategies by teachers of adolescents in the Kingdom of Saudi Arabia is considered as highly essential for ensuring that the overall performance of adolescents is improved to a considerable level (Ahmadi, Ismail & Abdullah, 2013). The use of memory strategies has enabled adolescents to increase their confidence level and knowledge level for exhibiting better performance at intermediate school level. Adolescents gaining access to effective memory skills in the Kingdom of Saudi Arabia reflects that their retention power and vocabulary has increased to a considerable level, thus supporting adolescents in better organisation of the tasks assigned to them. The use of memory-enhancing skills has further supported the development of interests and willingness among adolescents at intermediate school level for learning new languages and gaining additional knowledge that is highly useful for them in enhancing their overall performance. The teachers ensure that the memory strategies selected are based on the knowledge level of the adolescents and are highly effective and productive in ensuring that adolescents can learn them and practise them with

ease and in this aspect, memory strategies integrated by the teachers help in the development of a positive environment at the schools. The application of innovative practices has enabled adolescents to gain a deeper knowledge and access pertinent information that extends support to both adolescents and teachers by ensuring that the knowledge gained can be used by developing skills that extend support in gaining good grades at school level and attaining career goals in the long-term.

3.5.2 Conclusion

The outcomes show that the majority of teachers agreed that memory strategies are good for recall and that some of the strategies are easy to use. In contrast, the fact that the effect of memory strategies on student achievement increases as the approaches to learning increase could have importance in future education policies. This finding shows that it is possible that other factors may decrease the memory strategies' effect, such as a teacher's background within teaching. Moreover, teachers and parents may be able to work directly on improving children's approaches to learning by teaching them the use of memory strategy for recall.

3.5.3 Limitations and Future Work

The present research was based on the opinion of the teachers in relation to the role of memory in the learning process of adolescents. However, the use of interviews only with the middle schools adolescents has limited the scope of exploring a wider range of opinions on the effectiveness of a specific memory strategy in fostering the learning process of the adolescents. Future research can be conducted in a similar domain by using focus group and interview methods in two different research settings for carrying out a comparative analysis. Additionally, teachers of high schools can also be interviewed for determining the role of memory strategies in learning among high school adolescents. A lack of accurate and precise

information are some of the drawbacks of the interview method in this research. However, this chapter has helped in exploring the effectiveness of specific memory strategies for improving the learning process of the adolescents. Thus, the next chapter is directed towards comparing the different types of memory strategies which are used by the adolescents along with the ways of application of these strategies by the adolescents in Saudi Arabia.

Chapter Four

4.1 Introduction

This chapter investigates some of the different memory strategies that are used by teachers and learners and ways in which learners apply them. Memory is a necessary condition for mental life and the primary ground for psychological growth. There are many previous studies that have tried to examine memory strategies, starting from the early age of five years (Gaskill & Murphy, 2004; Eisenkraemer & Stein, 2015; Kornell & Flanagan, 2014; Schlagmüller & Schneider, 2002). The results of these studies indicate that there is a positive effect from these strategies, including sorting and encoding, on the adolescents' performance due to which type of memory strategy is used. However, there have been few studies exploring the effect of using these types of memory strategies to improve adolescents' performance in the adolescent age group (Schneider & Knopf & Stefanek, 2002; Luciana, *et al.,* 2005).Apart from this, it is evident that the learning strategies help students with various tools so that they can adapt to the present generation classrooms. These strategies are defined as techniques, rules and principles that help in acquisition, integration and storage. The study conducted on 325 Korean secondary schools about the learning strategies used by them shows that compensation strategies of learning were used by them the most and effective strategies were used by them the least. It was also concluded that the age, sex and the proficiency of the adolescents had a major impact on the use of learning strategies and it is clear that the literature on learning strategies overlaps with the memory strategy (Ok, 2003).

A study was conducted on teenagers studying in schools of Espinal, Tolima, and Colombia to analyze the most effective memory strategy in learning vocabulary. The three memory strategies involved in the study to learn vocabulary were association with pictures, word cards, and topic association through fables. The results show that students liked those

strategies more that were easy and enjoyable and could equally help them in learning vocabulary. Furthermore, it was found that all the three strategies word cards, association with the pictures, and association with the topic through fables were effective in increasing the vocabulary of students to a large extent (Pérez & Alvira, 2017).

In order to find out the different memory strategies used by students and to find out if there is any relationship between grades of students and types of memory strategies used, a sample of 175 adolescent students was taken. The most frequently used memory strategies were self-test, writing, practicing, chunking, and rehearsals. The study results show that majorly mental practice and self-test were the 2 majorly used memory strategies used by students to increase their learning skills (Alyami *et al.,* 2019).

The spacing effect is another very efficient memory strategy wherein instead of learning all the things simultaneously; students learn new things on different occasions. It benefits students in enhancing their retaining power by learning things occasionally. 39 students studying in middle school were tested, and results show that students can memorize new words better when exposed to the spacing effect. It shows that the spacing effect is an effective memory strategy that students can use to learn new things (Sobel, Cepeda & Kapler, 2011).

Studies 1 & 2 were aimed at investigating how students' memories affect their school work and their opinions about which memory strategies they think are effective for them as well as investigating teachers' opinions about the role of memory in students' learning and their opinions about the effectiveness of memory strategies. The results indicated that 68% of students used only one strategy with all subjects including the Quran, English, Arabic poetry and Maths. Also, the most used strategies were self-test (86.8% of students), mental practice

(82.3%), written rehearsal (76.6%) and practice aloud (60%). Moreover, 105 students (60%) used more than one strategy at the same time.

In a similar manner, the third study aimed at determining the most effective memory strategy for undergraduate university students from Arabic cultures. The outcome of this particular study could help to compare between different types of memory strategies, such as mental practice, written rehearsal, self-test, and practice aloud. Moreover, the study results could also help to determine the most effective memory strategy to enhance students' learning.

The aim of undertaking this study was to determine the most effective memory strategies for students from Arabic cultures. It was conducted as a pilot study for assessing the viability and effectiveness of the methodologies for study. Furthermore, it helped to check the appropriateness of the survey questions for the target study population. A pilot study helps to assure whether all the study participants can effectively follow the directions or not; it also helps to identify the appropriateness of the survey to fulfil the purpose of the study (Kim, 2011) and offers approaches, ideas, and clues that help in the successful completion of the main study (Arnold *et al.*, 2009). A pilot study also allows the researchers to analyse the validity and reliability of the analytical and statistical processes and usefulness of the data, therefore it was important to conduct this pilot study to test methods and procedures.

Here the study conducted is a pilot study. The data is collected from students of Arabic culture who are studying in UK. The Arabic students studying in different universities of UK are aged between 19-22 years. Here the age group of students is different as compared to earlier studies where the age group was 14-17 years. As the age groups are different the results of memory test and use of memory strategies will also be different. There is a difference between the type of memory strategies used by school students and university

students. The age of students is statistically significant from the memory strategies they use in their education. As students become more mature with passing age they become more serious and make more use of functional and social strategies (Chen, 2014).However this pilot study is conducted as a trail to the methods that will be used in large study for middle school students of Saudi Arabia.

The standard deviation in the age-group of the participants was 0.83, which depicts a significant difference in the age-group of the participants. In order to incorporate a diverse sample composition, the participants were recruited from each level of the undergraduate courses. Thus, students enrolled in first year, second year, and third year courses were invited to participate in the study, which helped to increase the statistical power of analysis. With reference to the aim of this study, the pilot study sought to compare the four different types of memory strategies: written rehearsal, mental practice, practice aloud, and self-test by utilising a small sample of Arabic speaking undergraduate students.

4.1.1 Research Background

Ensuing research about learning strategies generated a wide range of outcomes that included the role of gender and ethnicity as determinants of the use of learning strategy or memory strategy. It also included strategies for language learning allowing students to develop a responsible attitude towards their respective progress (Al-Ahdal and Hassan Al-Ma'amari, 2015). Different learning strategies could not be separated because learning outcomes came from the combined use of these strategies; furthermore, the combination involved an appropriate teaching strategy and individual learning styles. Nevertheless, literature also highlights that the most effective learning strategy involves an optimal use and clear focus on specific strategies (Al-Ahdal and Hassan Al-Ma'amari, 2015). Learning strategies are viewed mainly at mainly two different levels and the first level consists of rules

and actual techniques. This level is mostly focused on the single strategies used by adolescents. The next level is based on programs that consist of a collection of strategies (Berger & Karabenick, 2011).

The reason behind selecting the particular memory strategies used for this study is the evidence presented by previous researchers regarding the rationale of self-testing. In this regard, Kornell and Son (2009) suggest that self-testing is a crucial method, which significantly enhances memory. The authors found that the self-testing method helps to improve memory comparatively much better than reading the same information again and again. The effect of self-testing is visible when followed up with corrective feedback. Due to this, the self-testing method is included for assessment in this study. Koedinger, Corbett and Perfetti (2012) suggest that mental practice enhances the cognitive adaptation process of the students, which further leads to elaborative learning that is not possible with physical practice only. With the help of mental practice, students create an image in their mind regarding a pre-defined idea that potentially helps them in enhancing performance in athletics, music, and stroke rehabilitation. As the undergraduate students participate in extra-curriculum activities, such as playing the guitar, violin, and other sports-related activities to enhance their personality, mental practice plays a crucial role in the learning of students in many ways. Further, Braun (2010) presents the benefits of practising aloud for students that includes increased motivation, fluent reading, student engagement, and enhanced background knowledge. On the other hand, Ahourand Berenji (2015) emphasises that rehearsal has proven to be the most effective tool to memorise and for retrieval of information. This memory strategy is most popular among intermediate and undergraduate students, and it helps the students to keep the information in the long-term memory by repeating the information in a consistent manner.

From the perspective of Guerrero (1991), rehearsal is an important aspect of literature utilised in written production and is a basic part of the process of writing. Existing literature identifies the problem from the perspective of the first language. Rehearsal is believed to initiate with a dialogue in the mind and is not written anywhere. There might be involvement of some scribbling, conversation to others, discussion and imagining until the first draft of the writing emerges. The literature asserts that for most writers the major work of writing is processed in their minds. Such mental rehearsal is not limited to language, but utilises images in the mind of the writer and hence, is highly effective as a memory strategy (Guerrero, 1991). This aspect makes it highly recognised in psychology as a significant mnemonic operation. Within L1 learning mental rehearsal is identified as a manifestation of communication with oneself or inner speech and can be applied for written, as well as oral, use of language. Lately, it has also gained relevance in L2 as a highly relevant and common cognitive activity that offers a sense of a mental operation that is associated with the act of knowing and assists the process of learning at first and second level foreign language learning (Guerrero, 1991).

It is further considered that the use of mental practice has a substantial impact on improving the learning of sequential abilities. The literature highlights that a combination of mental and physical practice, such as in finger tapping for more than 6 weeks, led to an increased improvement in the speed of execution, in addition to the physical practice. Such improvements in performance of an individual can be associated with changes in the cortical maps related to the movement undertaken (Saimpont *et al.*, 2013). Performance improvement is examined after mental practice in another study in this context, and highlighted that such improvement was paired with a rise in activity in the orbit frontal cortex and a fall in activity in the cerebellum, both of which were identified as having taken place post physical practice in the functional representation of the same task. The findings thereby offer significant

evidence regarding the alignment of mental practice with motor imagery of sequential skills (Saimpont *et al*., 2013).

The relationship between mental practice and verbal rehearsal has also revealed similar outcomes as that of motor imagery. It is found that the impact of verbal rehearsal arises out of the linkage between language and movements, for instance, as postulated in the action-language-imagination model by Annett (1996) whereby two key channels, a verbal channel and a motor channel, are used to acquire information regarding a skill. The action language bridge operates between the two channels that allow the verbal description of an action and generates an action on verbal instructions. Assuming that there is a relevant relationship between movements and language, it is confirmed by the literature that rehearsing the various foot positions and engagement in motor representations evokes a part of the action and facilitates motor sequence learning. Based on these findings, it can be confirmed that mental practice as a memory strategy is based on mental imagery and visual rehearsing and hence these are helpful in accelerating the performance of a sequential motor task. The literature also highlights the ways in which visual rehearsing can influence motor performance. The use of visual rehearsal during mental practice can be effective in mental training (Saimpont *et al*., 2013).

In addition, this proposition can be further examined in the light of the findings obtained from chapter 2 that aimed at examination of the relationship between memory strategies and academic performance and determination of the effectiveness of memory strategies for students in Saudi Arabia. It was found from the findings of the survey in chapter 2 that the students used self-test and mental practice as memory strategies for enhancing their learning. Students used memory strategies in the form of written rehearsals, narratives, rhymes, self-test and mental practice in the context of the first research aim. It was

inferred from the analysis in regard to the second aim that students' grades and the type of strategies that students use were closely interrelated to each other.

As this study aimed to determine the memory strategies used by the students to memorise new information, definitions of these memory strategies are presented below:

1. Self-test: Self-testing is a memory strategy, wherein individuals quiz themselves in order to recall information for a long time. Self-testing allows the learners to determine what they know about a particular topic and the possible areas of improvements (Kornell & Son, 2009).

2. Practice aloud: Under this strategy, a word is spelt out aloud to get it into the long-term memory. Psychologists believe that the dual action of speaking and hearing have a significant impact on memory. It is determined that it is the dual action of speaking and hearing oneself that has the most beneficial impact on memory (St Clair-Thompson *et al*., 2010).

3. Mental practice: Mental practice is defined as a type of cognitive rehearsal of a task in the absence of physical movement. Under this strategy, an individual may use motor imagery, visual imagery, and auditory imagery or through observing the movement of others (Halford, 2014).

4. Written rehearsal: Rehearsal is a type of memory process that incorporates repeated writing of the important information in the short-term memory and relocating it into the long-term memory. The repeated practice of writing the key facts and information increases the familiarity of the students with the information (Weinstein, Acee & Jung, 2011).

4.2 Research aims

The aim was to test which memory strategies are more effective for Arabic cultures by investigating:

1. How the students normally memorise new information.

2. Comparison between four different strategies including practice aloud, mental practice, written rehearsal, and self-test.
3. Evaluation of memory behaviour: How the students apply new strategies they have learned.
4. To have a pilot study to check the viability of the methodologies that will be used in study 4

4.3 Method

4.3.1 Participants

Study 3 was a pilot study and for this particular study fifty-five Arab undergraduate students studying at the University of Lincoln were selected in order to determine the characteristics of the memory tests that the researcher would be using for the next study in Saudi Arabia (study 4), and to try out the procedures. The sample for the study included males and females, and the researcher worked with the Student Union to determine the number of Arab students at the University of Lincoln. A total of 42 students participated in this study comprising 33 males and 9 females. The average age of the sample participants was 19.45 years, with a standard deviation of 0.83. A total of 55 students were approached for this study, out of which 42 students completed the all training sessions and completed the survey questionnaire, while 13 students did not complete the training. On the other hand, only 10 students of the total study participants completed the interview questionnaire which is different from survey questionnaire. The demographic questionnaire asked about student age and gender and other questions were related to how they normally memorise new information, the type of memory strategy they use and why they used that particular approach to memorise. For the experimental (training sessions) part, six lists of words were used in the memory test and practice sessions (prepared by the researcher) and provided information about the appropriate characteristics of the word lists that the researcher would use to try out

the procedures. The printed copy of the interview questionnaire was distributed to all the 42 students who participated in training and they were asked to submit the filled questionnaire within 2 days. Only 10 students completed it and rest of the 32 students who willingly participated in the training sessions gave back the questionnaire as they were not interested to answer all the questions mentioned in the questionnaire.

4.3.2 Materials

In the current study, a questionnaire, which contained 3 questions, was used to collect data from students. The demographic questionnaire asked about student age and gender and other questions were related to how they normally memorise new information, the type of memory strategy they use and why they used that particular approach to memorise.

For the experimental (training sessions) part, six lists of words were used in the memory test and practice sessions (prepared by the researcher) and provided information about the appropriate characteristics of the word lists that the researcher would use to try out the procedures. All the word lists were written in Arabic so that the teachers and students can easily understand it. The list was provided so that researcher remembers the words that were used in study to test the students. The list will be used while analysing the results.

The questionnaire was prepared for determining how the participants normally memorise new information before training and the type of memory strategies they used. Students were also asked to determine why they used these types of strategies. In addition, students were asked to explain how they normally memorised new information after the training. Overall, the questionnaire was developed in alignment with the purpose of the study for investigating the usefulness of memory strategies among undergraduate students in the Kingdom of Saudi Arabia (KSA).

The questionnaire and the list of words were sent to specialists in developmental psychology at Gizan University and to some teachers, who had extensive experience in teaching, to ensure that the questions and the list of words were suitable for the stage. This suitability of the words was decided by five teachers who taught the same level in the University of Lincoln.

In addition to this, five professors from Gizan University, working in two departments (School of Psychology and Curriculum and Teaching Methods) also participated to decide the suitability of words for the current study. The team of five professors and five teachers prepared two lists of words suitable for undergraduate students in this study (see appendix).

The researcher approached the Arab students at the University of Lincoln, and their consent was given. The selected students were divided into two groups. The two groups had different set of words. First group contained eight words on biology, four on sleep and remaining four on writing implements while second group had eight words on biology, four on clothes and remaining four on playground items. In session 1, students were given 7 minutes, including 2 minutes for instruction and 5 minutes to show a word. Further, sessions 2, 3, 4, and 5 incorporated a memory test, wherein students were given adequate time to recall a word they had learnt using four different memory strategies: self-test, practice aloud, mental practice and written rehearsal. 5 minutes were allotted to the students to memorise all the words keeping in mind that different students have different ability to memorise. For instance, some students may take longer time, while some may take less time to memorise. Therefore,5 minutes of standard time was given to every student so that they can effectively memorise the words using a memory strategy. Different words were used in different sessions by the researcher so that the memory strategies used by the students can be studied effectively. For instance, in session 1, the researcher used the words Amphibian, Insect,

Tadpole, Caterpillar, Frog, Chrysalis, Toad, Sleep, Marker, Paintbrush, Blanket, Pencil, Bed, pillow, Crayon, and Butterfly. In another session, the researcher used the words Jacket, Feathers, Beak, Shirt, Slide, Swing, Playground, Moth, Caterpillar, Cocoon, Antenna, Nest, Socks, Monkey bars, Pants, and Bird. Simple and easy words were chosen for the study so that the students could easily memorise them. The correct response of the participant was considered as their measure of performance of the memory strategy. The students were given 1 point for each correctly recalled word and 0 points for wrongly remembered word. The outcomes and limitation of each method faced in this research would guide the researcher in using the same method with the students. The materials and memory strategies used in the current study would serve as a rich source of information for future researchers for the assessment of memory strategies in students.

4.3.3 Procedure

Participants were asked to memorise a list of 16 words presented sequentially (in random order). After reading the words, they were allowed 2 minutes to memorise them and instructed to use a particular memory strategy for recalling the words provided to them. The students were instructed to memorise the words with the help of four strategies namely self test, practice aloud, mental practice and written rehearsal. The words were selected in such a way that formed a series of related sentences so that the students are able to memorise them easily. The words were related only semantically but were from different categories so that it is easier to test the memory of the students. The words list contained eight words on biology (Amphibian, tadpole, frog, toad, insect, caterpillar, chrysalis and butterfly), four on sleep (sleep, bed, blanket and pillow) and four on writing implements (marker, paintbrush, pencil and crayon). Similarly, the other group had eight words on biology, four on clothes and four on playground items.

For study 3, which was, as stated, a pilot study, Arab students studying at the University of Lincoln were approached by the researcher and the consent of participants was obtained. The students were invited to this study by the researcher, and the test was administered individually by the researcher in a quiet conference room at the School of Psychology department for 15 minutes every session with a two day break between the sessions. The students were given a brief description of the study aim, the invitation and participant sheets. The participants were divided into two groups based on the number of participants to void the order effects and each group saw a different order of the wordlist. . The participants were divided in random order and the groups differed only in condition order.The students were asked in session 1 (first day) to take 7 minutes, including 2 minutes for instruction and 5 minutes to show the words. In the first two minutes, the instructions concerning the four different memory strategies to be used were given to the students. Students were explained about the strategies, as well as the way to use the strategies. The students were also explained about the significance of the strategies. The second day started with a memory test by recalling as many as possible of the 16 presented words which they had seen on the first day followed by a 5 minute test and 6 minutes to answer the questions. In session 2, which began two days later, the first group of students were asked to take 7 minutes: 2 minutes for instruction and 5 minutes for showing the words and practising (the list of words and type of memory training was selected by random order). After an hour the second group started, and they used the same steps as the first group. In the second day of this session, the students were asked to do a memory test for 5 minutes. In the following three sessions the same procedure was used as in session 2, but the difference was in the type of memory strategy that they practised. In session 6, the participants were asked to repeat session 1 after they had learned. The number of correct responses was used as a measure of their performance. The students were given one point for each correctly recalled word, with a

maximum of 16 points. Thus, there were six actual performance scores, with a maximum of 16 points each, for each student. The printed copy of the interview questionnaire was provided to each student after the completion of training session.

Session 1	
Day 1: 2 minutes instruction and 5 minutes to show the words.	**Day 2:** Memory Test
Session 2	
Day 1: **Group 1:-** 2 minutes instruction and 5 minutes practising the words. **An hour later…** **Group 2:-** 2 minutes instruction and 5 minutes practising the words.	**Day 2:** Memory Test
Session 3	
Day 1: **Group 1:-** 2 minutes instruction and 5 minutes practising the words. **An hour later…** **Group 2:-** 2 minutes instruction and 5 minutes practising the words.	**Day 2:** Memory Test
Session 4	
Day 1: **Group 1:-** 2 minutes instruction and 5 minutes practising the words. **An hour later…** **Group 2:-** 2 minutes instruction and 5 minutes practising the words.	**Day 2:** Memory Test
,Session 5	
Day 1: **Group 1:-** 2 minutes instruction and 5 minutes practising the words. **An hour later…** **Group 2:-** 2 minutes instruction and 5 minutes practising the words.	**Day 2:** Memory Test
Session 6	
Day 1: 2 minutes instruction and 5 minutes to show the words.	**Day 2:** Memory Test

4.3.4 Design

A repeated measures design was used to compare five conditions: control and four experimental conditions in which participants were instructed to use different memory strategies, such as practice aloud, mental practice, written rehearsal, and self tests, at the study phase. Memory was assessed by free recall as this is similar to the style of assessment experienced by students in Saudi Arabia. The specific strategies were selected based on the results of Studies 1 & 2. The control condition was tested first to establish the baseline. Following this, the order of the experimental conditions was randomised to avoid order effects. The dependent variable was the number of words the students could recall.

Session	Instructions	Practice Strategy	Show words	Memory test	Questionnaire
1	2 mins	n/a	2 mins	5 mins	6 mins
2	2 mins	Practice Aloud 5 mins	2 mins	5 mins	n/a
3	2 mins	Mental Practice 5 mins	2 mins	5 mins	n/a
4	2 mins	Written Rehearsal 5 mins	2 mins	5 mins	n/a
5	2 mins	Self Tests 5 mins	2 mins	5 mins	n/a
6	2 mins	n/a	2 mins	5 mins	6 mins

4.3.5 Ethical issues

Before initiating the study, a UK DBS clearance was facilitated through the University of Lincoln. Although, DBS clearance was not necessary as the students are undergraduate students; however, it was still facilitated to check the criminal background of the students and select appropriate students who can enthusiastically and positively

participate in the study. The students were given written information about the project in advance, including the right to withdraw and how to withdraw their data. Participants, including male and female students, were identified by a participant code number. No names or other personal identifiers were recorded on the memory test sheets. Participants were asked to give information freely. Any sign of the participant wishing to withdraw was noted and acted upon (e.g., asked whether the participant was comfortable, wished to continue, or wished to withdraw from the study). Participants were made aware of their right to withdraw their participation or data from the study. Data could be withdrawn up to two weeks after the final testing had been carried out by contacting the researcher through the school and providing the participant code number. The School Psychology Department at the University of Lincoln was asked for a suitable room for the test to be administered with more privacy. At the end of the memory test a debrief form was sent to students' personal or professional e-mail. Debrief contained the participant's unique number, a brief explanation of the study, a thank you message for their participation and the researcher's e-mail in case they wanted to withdraw their data. At the end of the memory test and questionnaire, a debrief form was provided to the students directly.

4.4 Results

4.4.1. Analysis of Qualitative Data

Content Analysis

Content analysis was used in this study to analyse the qualitative data regarding the memory strategy used by the students. The qualitative data for the current study was collected with the help of an interview questionnaire. The interview questionnaire incorporated questions regarding age-group, gender, way of memorising new information, type of memory strategy, and any particular approach to memorise a new word. The response collected from

the participants was analysed by reading the transcripts multiple times and identifying the major categories. Further, the keywords were identified from the response collected from pre-training and after-training participants. The keyword frequency was calculated by analysing student responses to three interview questions. Further, this frequency was compared in pre-training and after-training for making a meaningful interpretation.

Table 4.1 *Themes and keyword for Content Analysis (Pre-Training)*

Theme	**Category**	**Keywords**	**Frequency**
1. How do they normally memorise ne information?	Pre-Training	Drawing	1
		Rehearsal method	1
		Finding similar words	1
		Writing	1
		Reading	4
		Depend on Type of information	1
		Do not have any specific method	1
		Singing	1
2. Which type of memory strategy	Pre-Training	Painting	1

used?			
		Relating	2
		Self-test	1
		Linking	3
		Singing	2
		Rehearsal	2
		Looking for a similar word	2
		Memory Strategy	1
3. Why they used that particular approach to memorise these words?	Pre-Training	Easy	5
		Using from childhood	2
		My way	2

Table 4.2 *Identifying Themes and keyword for Content Analysis (After-Training)*

Theme	**Category**	**Keywords**	**Frequency**
1. How do they normally memorise new information?	After-Training	Practice Aloud	1
		Relationship between the words	1

		Selecting memory strategy	3
		Linking the words	1
		Sing the information	1
		Reading	3
		Linking words with meaning of words	1
2. Which type of memory strategy do they use?	After-Training	Practise aloud	2
		Self-test	2
		Finding relationship	4
		Written rehearsal	3
3. Why did they use that particular approach to memorise these words?	After-Training	Easy	6
		Good learning	1
		Don’t Know	1
		Using from Childhood	1

Coding of Data

From the above tables, the most frequent words reported by the participants were chosen and coded as alphabets A, B, C, D, E, F, G, H. The frequency of reporting these words by the participants was counted and compared for the pre-test and post-test group. The labels were decided according to the frequency of words reported by participants in the pre-test.

Table 4.3 *Coding of Data*

Keyword	**Label**	**Session 1(pre-test)**	**Session 5(post-test)**
Using memory strategy is easy	A	6	5
Reading	B	4	3
Do not have any specific method	C	1	0
Self-test	D	1	2
Singing	E	1	1
Rehearsal	F	1	3
Linking to similar word	G	1	6
Practice Aloud	H	0	3

Students' Approach to Memorise new Information

The above table indicates the student's response to the type of memory strategy pre-training and post-training. A total of 10 students completed the interview questionnaire, comprising 2 females and 8 males. It was analysed from the above table that the majority of the students used a reading strategy for memorising a word before the training. In this regard, a female student indicated before training that, *"I always read and write the new information which I need to remember"*. Further, before training interview participants also reported that they do not use any specific method use for memorising words. Although, there was no evidence that could clarify that students did not change their preferred memory strategy; however, it could be analysed from the statements of the students that they have used the preferred memory strategy. Their statements showed their sincerity towards using the preferred memory strategy.

Type of Memory Strategy used by the Participants

The students were provided training in 4 different types of memory strategies for a week, and the effectiveness of memory strategies was examined from their response to an interview questionnaire. Self-tests and rehearsals were some memory strategies used by the participants after the training. After providing training of the memory strategy, a female student said that, *"I found that the self-test is a good method for memorising the new information".* Before training, students also thought that linking the new word with a similar word was the best approach to memorise a new word. In this regard, a female respondent said that*, "Because if I linked any information with something easy it will help me not to forget".*

Reason of Using Particular Approach to Memorize Words

After providing training, students were influenced to use self-test and rehearsal for memorising a word and reported that, *"By using the rehearsal method and linking these*

words it became something easy for me". However, the students also perceived utilising a memory strategy to be a complex method as compared to traditional methods such as reading and writing. In this respect a male student stated after training:" *I used these methods because they are easy for using and confirm that this information stays longer in the memory."*

4.4.2 Analysis of Quantitative Data

Introduction

This study utilised ANOVA with repeated measures as the same type of entities were used in the experiment. ANOVA test is used for determining if there are any variations between groups in a sample. Here, the dependant variable for the test is the memory of the student as the effectiveness of the four different memory strategies is focused on analysing the student's ability to memorise the words using these strategies. The current study aimed to determine the usefulness of memory strategies for adult students in the UK to recall a word. However, the effectiveness of students to recall a word correctly may depend on the type of memory strategy used. In regard to the current study, the students were instructed to use four types of memory strategies in the present study, namely practice aloud, mental practice, rehearsal and self-test. The significant difference in these four types of memory strategies were tested using repeated measure ANOVA, the results of which are shown below:

Analysis Of Variance for four types of Memory Strategies (ANOVA Repeated Measures)

Table 4.4 *Descriptive Statistics*

Group Statistics

	STUDENT-GENDER	N	Mean	Std. Deviation	Std. Error Mean

Practice aloud WR	MALE	33	8.97	2.54	.44
	FEMALE	9	9.89	2.57	.86
Mental practice WR	MALE	33	10.09	2.67	.46
	FEMALE	9	10.89	1.83	.61
Rehearsal WR	MALE	33	10.21	2.65	.46
	FEMALE	9	8.22	2.59	.86
Self-test WR	MALE	33	11.64	2.12	.37
	FEMALE	9	12.33	1.94	.64

Table 4.5 *Descriptive statistics of scores of students corresponding to different memory strategies*

Descriptive Statistics			
	Mean	Std. Deviation	N
Practice aloud WR	9.17	2.54	42
Mental practice WR	10.26	2.59	42
Rehearsal WR	9.78	2.74	42
Self-test WR	11.78	2.08	42

Tables 4.4 & 4.5 provide descriptive measures corresponding to the four types of memory strategies. It was analysed from the below table that the mean score of the participants is highest for the self-test (M= 11.78). On the other hand, the lowest score of recalling has been calculated corresponding to Rehearsal.

Repeated Measured ANOVA for analysing the effectiveness of Memory Strategies

As per the main output of ANOVA for repeated measures, the assumption of sphericity has been met; therefore, standard results are used to report the results of ANOVA. It could be reported based on the output of ANOVA with standard results that the mean scores for students corresponding to memory strategy is statistically significantly different ($F(3, 123) = 10.57$, $p < 0.05$, $\eta^2_p = .205$). Bonferroni-adjusted pairwise comparison shows that scores of students who used the memory strategy of practising words aloud (M=9.17, SD=2.54) was significantly lower than rehearsal (M=9.78, SD=2.74) after the pairwise comparisons of the incorporation of memory strategy (p=.00) at 95% CI[-3.67,-1.56] (Refer table 3 from appendix).

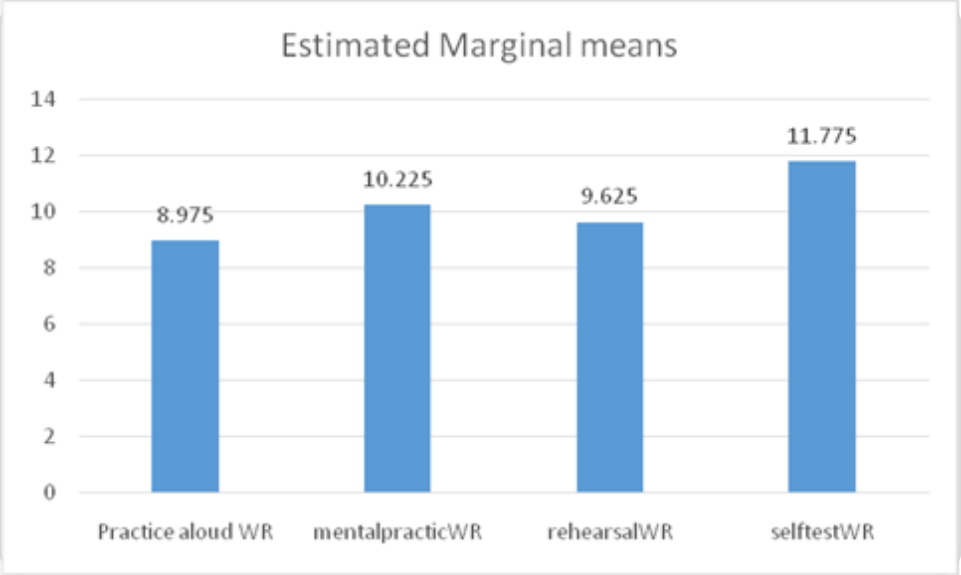
Bonferroni post hoc test was performed in order to analyse which specific means differed significantly. The results of Post hoc to one-way ANOVA with repeat measures; where in each pair have been compared in different conditions. It was identified that mean difference is not significant for practice aloud and rehearsal (p>0.05) nor for mental practice and rehearsal (p>0.05). Except for these two groups, the mean difference is significant for the other pairs of memory strategies

Types of Memory Strategies

Table 4.6 shows the descriptive statistics corresponding to four different types of memory strategies used in the study at 95% confidence interval.

Table 4.6 *Descriptive statistics for memory strategies*

Descriptives				
			Statistic	Std. Error
practicouldWR	Mean		9.1667	.39142
	95% Confidence Interval for Mean	Lower Bound	8.3762	
		Upper Bound	9.9572	
	5% Trimmed Mean		9.1270	
	Std. Deviation		2.53672	
	Minimum		5.00	
	Maximum		14.00	
mentalpracticeWR	Mean		10.2619	.38866
	95% Confidence Interval for Mean	Lower Bound	9.4770	
		Upper Bound	11.0468	
	5% Trimmed Mean		10.3175	
	Std. Deviation		2.51880	
	Minimum		5.00	
	Maximum		14.00	
rehearsalWR	Mean		9.7857	.42228
	95% Confidence Interval for Mean	Lower Bound	8.9329	
		Upper Bound	10.6385	
	5% Trimmed Mean		9.7619	
	Std. Deviation		2.73670	
	Minimum		5.00	
	Maximum		15.00	
selftestWR	Mean		11.7857	.32067
	95% Confidence Interval for Mean	Lower Bound	11.1381	
		Upper Bound	12.4333	
	5% Trimmed Mean		11.8148	
	Std. Deviation		2.07818	
	Minimum		8.00	
	Maximum		15.00	



Impact of Ordering on Practicing Memory Strategies

Since the variances of the differences are equal, thus, standard ANOVA results have been utilised. The mean difference is significant for different types of memory strategy as F (3, 120) = 11.64, p = 0.00< 0.05, $\eta^2_{p=}$ .225. The interaction of the type of memory strategy and group effect is also significant at a 5% level of significance as F (3, 120) = 5.141, $\eta^2_{p=}$ .114, p = 0.002< 0.05). The score of students increased in post-test after utilising a memory strategy (M=11.86, SD = 2.09) as compared to pre-test (M=7.33, SD=3.15).

Between-Subject Difference in the Group 1 and Group 2

From the outcomes for between-subject effects, it was analysed that F (1, 40) =2.44, p=.126>0.05. Thus, it can be determined that there is no significant difference in the mean scores of participants in group 1 and group 2 for memorising a word.

Student behaviour to apply a new Strategy

Pair Sample T-test

A paired samples t-test was utilised in the current study to analyse the student's behaviour to test effective application of the new strategies that they have learned.

The results of the paired sample t-test reflect that the students' scores on the memory test have been compared before and after utilising a memory strategy. On average, pre-test scores were lower (M=7.33, SD=3.15) as compared to post-test scores (M=11.85, SD=2.09). The improvement 4.52, 95% CI [-5.41653, -3.63109] was statistically significant as t (41) = 10.23, $p< 0.0$. Since the *p* of the t-statistic is less than a pre-determined level of significance (0.05), it can be inferred with a 95% confidence level that the alternate hypothesis has to be accepted. Thus, the study results demonstrate that the students could effectively utilise the new strategies that they have learned (Refer Table 12 from Appendix).

4.5 Discussion

4.5.1 Summary of primary and secondary findings

A mixed research approach was utilised in this study for the examination of memory strategies on a sample of adult participants. The questionnaire was used to recognise the type of memory strategies used by the students. This study was a pilot project that was used by the researcher to check the validity and reliability of the questionnaire to accomplish the further objectives of the impact of memory strategies on students.

The findings of the content analysis showed that both male and female Arab students, who were studying in England at the University of Lincoln, used reading and writing to memorise new information. In regard to the first aim, it was identified from content analysis that students before training did not use any specific method to memorise new information. On the other hand, post -training students found that self-test was an effective method to memorise new information after training. It was deduced from the content analysis that students perceived memory strategies as a complex method in comparison to the traditional memory strategies, such as reading and writing. Further, it can also be concluded that by

using a specific type of memory strategy, they were able to memorise the information for a longer time.

Further, it was also identified from literature findings of Eisenkraemer & Stein, (2015) that memory strategy plays a vital role in learning and academic achievement of students (Eisenkraemer & Stein, 2015). Moreover, Weinert & Perlmutter (2013) have also provided evidence of the fact that the academic achievement and memory power of the student may differ, based on the type of memory strategy used by them (Weinert & Perlmutter, 2013). It was also recognised from the quantitative outcomes that that there was a significant difference in the scores of students for recalling a word, when they used a different memory strategy. Further, in regard to the second aim, it was shown from 2x4 ANOVA that mean scores of students for recalling a word correctly was significantly higher for the self-test as compared to other memory strategies such as practice aloud, rehearsal, and mental practice. The results of the paired sample t-test also determined that students were able to utilise the memory strategy to enhance their learning after being provided with training. In reference to the third aim, it was recognised that memory strategy improved learning of undergraduate students and increased their motivation, background knowledge and engagement in the academic content taught by teachers. Further, self-testing also influenced long-term memory of the learners and helped them to assess their own knowledge about a subject.

The aim of this study was primarily to check the validity and reliability of the questionnaire and it was carried out as a pilot study to this end. Nevertheless, this third study can also be regarded as a study in its own right as it produced findings that could be compared with the outcomes of other studies. In addition, the undergraduates in this pilot study were at a university in the UK, whilst the Saudi middle school samples were unlikely to have had that exposure to English language.

Another problem that was identified in this pilot study was that the questionnaire was too long and needed to be shortened. This led to some boredom on the part of the undergraduate participants as the questionnaire was left incomplete. It indicates that certain memory strategies are more effective than others, especially when related to age and context. The strategies for Arabic learners have shown a difference between the university undergraduates with more experience of learning and the adolescents in middle schools in Saudi Arabia. Selecting memory strategies may depend on the exposure students have had to learning and thus this is related to their level of education and age. It has also shown that the wrong memory strategies selected for a specific group can have a detrimental effect and lead to learners not using any memory strategies at all.

4.5.2 Limitations and Future Work

One of the major limitations of the study was the lack of detailed qualitative analysis, which could be done with the help of a structured interview or focus group study. In this regard, future researchers could conduct an interview with university teachers. The lack of in-depth qualitative analysis was an issue as it restricted exploring different dimensions related to memory strategies. The interview questionnaire included only 3 questions that limited the scope of the investigation of the research issue.

Further, a greater difference in the proportion of male and female participants was identified as one of the weaknesses of the study, which over-represented the perception of memory strategies of males rather than females. The time required to do the test was a bit long and this was because of the ease of words for the undergraduate students. Further, some of the students were feeling bored because the level of words was too low for this age group. Some of the students said that when they found it difficult to use the strategy they practised, they decided to use the strategy they always use. All these issues affected the reliability and

validity of the study outcomes. These issues should be adequately handled by a future researcher. Further, a larger difference in the sample size of male and female respondents might also affect the credibility of the research outcomes, if conducted on large samples. Therefore, future researchers should identify a proportion of male and female participants in a research setting, which will help them to recruit an appropriate sample size in the male and female category.

4.5.3 Conclusion

It has been deduced from the current study that students did not recognise the significance of using a memory strategy before training. The students after being provided with adequate training for the memory strategy felt that these strategies helped them to recall new information for a longer time. Along with this, the study findings also concluded that the four memory strategies (practice aloud, mental practice, rehearsal, self-test) used in this study were not effective at the same level for increasing a student's recall power. The findings of the questionnaire depicted that self-test was the best method to recall new information as perceived by the sample participants. Apart from this, the study findings also explored that students could effectively use the memory strategies that they have learned during the training sessions to remember a new word. In addition to these findings obtained from the pilot test conducted in this chapter to test which memory strategies were more effective for the students from Arabia, the study also offered important findings regarding the suitability of the method developed for the collection and analysis of the data to address this aim, in the form of a pilot test. In this regard, the pilot test was highly effective in delivering the desired outcomes in respect of the suitability of the language, number of questions, time duration for pre and post testing phases, features of the sample and the sample size. Based on the outcomes of this pilot test, it was identified to be most appropriate in addressing the research aim, the same elements of the method for data collection and analysis was applied for this

research in the next chapter or the next study. Hence, no changes were made in the final application of this method in respect of language, nature, number of survey questions and the methods and statistical tests applied in this study 3 and the procedure was followed exactly without any changes. The pilot test conducted in this study was, therefore, highly effective in determining the number and nature of research variables and being able to conduct the final analysis for this research in a correct and appropriate manner. The next chapter presents a further study which investigates the way in which students memorise information and how they apply the new memory strategies they have been taught.

Chapter Five

5.1 Introduction

Overview of problem

Memory is described as recalling of information that students learn or experience in their daily life or in the academic curriculum. Students need to remember the information they have learned in their class in order to achieve high grades. In regard to this, previous researchers have found that using a technique could help the students to remember and recall the information. The current study is undertaken to examine the way in which students memorise the information and the study has also focused on determining the opinion of students regarding the memory strategy that they found most effective.

Relevance of this Study

Outcomes of previous studies have described that there is a positive impact of a particular memory strategy on the performance of students (Zhang et al., 2016; Ahour & Berenji, 2015; Braun, 2010; Gaskill & Murphy, 2004). However, previous researchers have not conducted a study to compare the effectiveness of four different types of memory strategies. Moreover, the previous studies have not presented evidence of the fact as to which type of memory strategy can be more effective for students to memorise information. Therefore, this research is crucial to bridge the gap in the literature regarding the effectiveness of four different types of memory strategies, such as practice aloud, mental practice, self-test, and written rehearsal for the students to recall new information. The findings of this study will help to identify the strategies used by students to memorise new information. Furthermore, the study findings will also help to identify the student's memory behaviour, as to how they apply memory strategies to apply the new information that they have learned. The study will thus be exploring the following:

1. How students normally memorise new information.
2. Comparison between four different strategies, including practice aloud, mental practice, written rehearsal, and self-test.
3. Evaluation of memory behaviour: How the students apply new strategies they have learned

Research Background

Sozler (2012) explained that the process of language learning could be enhanced through various strategies and techniques. Consequently, students and teachers should be aware of different language learning strategies. The authors also found that the majority of the educational institutes were using traditional methods in which the teacher controlled the learning environment and held the entire responsibility of student development. Such a learning environment resulted in thousands of non-proficient English speakers. However, one of the major goals of learning strategies should be focused on enhancing communicative competence among students. Vocabulary is generally considered as the best communication tool as it is regarded as one of the most problematic issues for language teachers. Without having adequate knowledge of words, students are not able to communicate with others effectively. Studies used to enhance memory have attracted a number of authors over the past decades. However, the previous authors have not presented evidence of memory strategies used by students in KSA. Thus, this study is undertaken to analyse the memory strategies used by a sample of students in KSA.

A further study by Dunlosky *et al.* (2013) described different memory or teaching methods used by school students. It has been found by researchers that the most popular memory strategies among students are self-explanation, re-reading, practice testing, rereading, highlighting, interleaved practice, and imagery for text. It has been identified from these previous research findings that practice aloud and re-reading are two crucial memory

strategies used by the students as a part of self-regulated learning. In this regard, authors also found that rereading is a technique used by students while preparing for their exams. Further, Hartwig and Dunlosky (2012) conducted a survey to know whether students read an article, textbook, or any other source material more than once in order to memorise new information. From the analysis of the results, authors found that the majority of the students-read some important parts of their course, which other re-read entire chapters. Moreover, researchers also stated that the high-performing students-read each piece of information at regular time - intervals. In a similar regard, Karpicke, Butler and Roediger (2009) identified memory strategies used by the undergraduate students, wherein the students were asked to rank the memory techniques in terms of frequency of use. The authors identified that re-reading and mental practice were two top-ranked memory strategies among the students.

Reading information again and again may help to improve the memory. Dunlosky *et al.*, (2013) stated that undergraduate students read a passage about making leather or a passage of 750 words about Australian history once, twice, or up to four times to memorise it. The authors also found that when the students in vested an increased amount of time on reading, it helped to encode the information more effectively. Hartwig and Dunlosky (2012) conducted a survey among college students to access the memory strategies used by them. The researchers identified the impact of self-testing and scheduling on students' achievement. The authors stated that self-testing was preferred by college students to monitor their learning process. It was also found that self-test was the most effective memory strategy that helped the students to boost their academic performance and grade point average.

Furthermore, Kornell and Son (2009) investigated learners' opinions and beliefs about memory strategies. The researchers used a flashcard like procedure and students were asked to rate the effectiveness of self-test for recognising a word. The researchers conducted two experiments that included the same set of material that differed in one or two aspects during

their processes. In experiment 1, the participants were asked to choose one strategy between testing and presentation, while participants in experiment 2 were asked to choose one between presentation and testing. However, the researchers found that students used self-test to examine their level of learning not to improve the learning.

According to Banikowski and Mehring (1999), students' knowledge regarding the structure of text played a crucial role in comprehension. The authors further elaborated that various strategies were used to assist the students in memorising information for a long time, including highlighting the text, underlying, and preparing power notes. The additional strategies included study guides, story reading, reading, and graphic organisers. The researchers explained that storytelling helped the students to memorise the course information in the form of stories. Dunlosky *et al.* (2013) identified that writing served as a good learning tool among students as it facilitated the learners to organise the information they memorised through critical thinking. It helped students to refine their critical and logical thinking and helped them to recall the information over a longer period. Written rehearsal helped the brain to process the information in an in-depth manner. On the other hand, less formal writing could be used to recall later, improve comprehension, and become learning logs. Further, it was also identified that mental images were a crucial memory strategy for the students as it helped the students in remembering and organising the information that was mentioned across the text.

Hartwig and Dunlosky (2012) emphasised that the effectiveness of a memory strategy may also depend on the situation and need. There may be some time when the students are asked to discuss the memorised information. In this case, the learner needs to repeat the information in various ways, but it does not require the learner to understand the meaning or context. Thus, the effectiveness of a memory strategy is affected by environmental conditions also and the objective of learning.

Evidence of the Previous Researches

The study findings of previous research indicate that memory can be regarded as a vital part of the development and efficient working of mental processes as it creates a link between past events and present to build experiences for developing the thinking processes among human beings. The integration of memory enhancement strategies into the educational system is essential for helping students in learning varied ways of recalling, recognising, and organising information in an easy to understand manner (Al-Bidawi, 2018).

In order to understand the way memory plays a vital role in enhancing the learning process, various learning theories, including Memory Traces theory and Gestalt theory proposed by educational psychology, were analysed. The studies have explained memory trace theory as a theoretical model that assists in analysing memories that are stored in the brain. Further, it can be mentioned that the Gestalt theory primarily highlights how experiences and perceptions of learners can impact on their learning. The existing education system in the Kingdom of Saudi Arabia (KSA) necessitates students to pass criteria at the first stage in order to move to the next stage. Some assessments in the KSA education system integrate exercises such as English vocabulary, reciting the Holy Qur'an, and Arabic poetry that test remembering or memory strength of students.

Purpose of this Study

This study was focused on determining the memory strategies that are effective for students from Arabic cultures. Four different types of memory strategies have been studied and analysed, namely, practice aloud, mental practice, written rehearsal, and self-test. Further, this study focused on analysing the impact of memory strategies on students' learning.

5.2 Research aims

The aim was to test which memory strategies are more effective for Arabic cultures by investigating the following:

1. How the students normally memorise new information.
2. Comparison between four different strategies including practice aloud, mental practice, written rehearsal, and self-test.
3. Evaluation of memory behaviour: How the adolescents apply new strategies they have learned.

5.3 Method

5.3.1 Design

A repeated measures design was used to compare five conditions; control and four experimental conditions in which participants were instructed to use three different memory strategies at the study phase. Memory was assessed by free recall as this is similar to the style of assessment experienced by adolescents in Saudi Arabia. The specific strategies were selected based on the results of Study 1 & 2. The control condition was tested first to establish the baseline. Followed by this, the order of the experimental conditions was randomised to avoid order effects. The dependent variable was the number of words the adolescents could recall.

The 120 interviewed participants were randomly divided into two categories, wherein 30 participants formed the control group, while the remaining 90 participants formed the experiment group. The 90 participants of the experiment group were further subjected to 4 different sequences of the 4 memory practice strategies. In each group there were 60 males and 30 female participants. All the adolescents were selected from 5 schools.

After working with the Ministry of Education for selecting the samples, five schools including 3 boys' schools and 2 girls' schools were selected. The most suitable schools for the study were selected after working with the Ministry of Education. There was no intention of gender imbalance; however, due to the selection of 3 boys' school and 2 girls' school, according to suitability, the gender imbalance is observed in the study. For the boys' schools, 3 classes from 3 schools, and each class from each school were selected. Among these classes, two classes acted as intervention groups and half a class (15 adolescents) as a control group. For the girls' school, 2 classes were selected from 2 schools that are one class for intervention and half a class as a control group. Further, two half classes from boys' and girls' schools were selected to get one group as a control including both boys and girls. At the end, three intervention groups were obtained including 2 classes from boys' schools and one from a girls' school plus two half classes from boys' and girls' schools.

5.3.2 Participants

Approximately 120 adolescents were selected for the study from third graders /intermediate schools, aged 15 years old. Participants were selected from schools in the GIZAN area of Saudi Arabia. The sample for the study included boys and girls, and the researcher worked with the Ministry of Education to determine the number of schools there were in the city, and then selected the schools. The selected schools were the same as the earlier study and the method of selection of the schools was also same as the previous studies. Stratified random sampling was used to select a sample of schools and classes from those schools, based on school numbers. The stratified sampling included the categorisation of population into homogenous subgroups and then a random sampling method was adopted to select members from each group. The rationale of using the stratified sampling is that it enables the researcher to obtain a sample that represents the entire population effectively. A total of 120 adolescents were approached in this study, comprising 77 boys and 43 girls

including both in control groups and intervention groups. As the proportion of boys is more in schools as compared to girls that's why the number of female respondents is less as compared to boys. For the control group, a total of 30 adolescents were approached in this study, comprising 17 boys and 13 girls, but only 17 adolescents completed the questionnaire out of the total control group. The number of adolescents who left the questionnaire blank or marked it incorrectly was 13 adolescents, including 10 boys and 3 girls. While reading the adolescents' responses to the questionnaire, it was recognised that 10 out of 17participants from the boys' school and 3 out of 13from the girls' school kept some questions blank or wrote something not related to the questions. On the other hand, all the 30 participants, including 17boys and13girls took part in the memory tests.

A total of 90 adolescents were approached for this study for an intervention group, comprising 60 boys and 30 girls, but only 77 adolescents completed the questionnaire. The interview was also scheduled at school. For the intervention groups there were 3 groups, two from the boys' schools and one from the girls' school. There were 13 adolescents who left the questionnaire blank or marked it incorrectly. The 13 adolescents who left the questionnaire blank were from the boys' groups. On the other hand, all the participants in the intervention groups took part in the memory tests. Thus, the total effective sample size of the study was 94 adolescents, including 77 in the intervention group and 17 in the control group.

The adolescents in this study were recruited in the same proportion as the proportion of boys' and girls' adolescents in selected schools. All the selected research participants used four different types of memory strategies in different weeks. The mean age for participants was 15. 45 years old (Standard Deviation 0.71, N = 120, Range 14-17 years).Table 5.1 shows the results for pre test, as the post- test was conducted after few days of pre-test there is no such major change in the age of students. This table demonstrates that the average age of the pre-test male participants in the control group was 13.47 with a standard deviation of 2.18and

the mean for male participants in intervention was 14.50 with standard deviation 2.07. The mean of female participants in control group was 14.15 with standard deviation of 1.90. The mean of female participants in intervention was 15.03 with standard deviation of 1.12.

Table 5.1 *Descriptive statistics of adolescents age and gender* test*

	STUDENT-GENDER	Control OR intervention	Mean	Std. Deviation	N
pre-test	MALE	control group	13.47	2.18	17
		intervention	14.50	2.07	60
		Total	14.27	2.12	77
	FEMALE	control group	14.15	1.90	13
		intervention	15.03	1.12	30
		Total	14.76	1.44	43
	Total	control group	13.76	2.06	30
		intervention	14.67	1.82	90
		Total	14.45	1.91	120

5.3.3 Materials

In the current study, a questionnaire which contained 3 questions was used to collect data from adolescents. The details of materials are the same as for study 3 and is summarised in the section below. The full details are reported under the method section of chapter 4.

The demographic questionnaire asked about student age and gender and other questions was related to how they normally memorise new information, the type of memory strategy used and why they used that particular approach to memorise these words.

For the experimental (training sessions) part, six wordlists were used in the memory test and practising sessions (prepared by the researcher) and provided information about the appropriate characteristics of the wordlists that the researcher used. The 2 sample wordlists used in practice sessions are displayed in the appendix session (Appendix A of Study 3). All the wordlists were written in Arabic and were sent to specialists in developmental psychology at Gizan University and to some teachers who had extensive experience in teaching, to ensure that the questions and the lists of words were suitable for the stage. This suitability of the words was decided by five teachers who teach the same level in the Saudi schools.

The questionnaire was prepared for determining how adolescents normally memorise new information before training and the type of memory strategies the adolescents used. Adolescents were also asked to determine why they used these types of strategies. In addition, adolescents were then asked to explain how they memorised new information after training. Overall, the questionnaire was developed in alignment with the purpose of the study and investigating the usefulness of memory strategies among undergraduate adolescents in the Kingdom of Saudi Arabia (KSA).

In addition to this, five professors from Gizan University working in two departments (School of Psychology and Curriculum and Teaching Methods) also participated to decide the suitability of words for the current study. The team of five professors and five teachers prepared 2 lists of words that were suitable for third graders /intermediate schools. (See appendix).

The questionnaire and lists of words were designed for determining memory behaviour and which memory strategies were more effective, by comparing between four different strategies, including practice aloud, mental practice, written rehearsal, and self-test. The researcher prepared the room, questionnaires, memory tests and pens for the participants.

The experiment and the questionnaire were prepared for exploring how the adolescents normally memorise new information, comparing between four different types of memory strategies, including practice aloud, mental practice, written rehearsal, and self-test and evaluating memory behaviour by exploring how adolescents applied new strategies they had learned.

Instruction given to adolescents during the performance of memory test

Table 5.2 shows that the instructions given to the adolescents about the memory strategies are described as follows:

Mental Practice
o The words would be shown on the screen for 5 mins o You have to memorise these words by using a mental practice strategy, including looking at the word form and thinking of the meaning of this word, but without pronunciation of the word.
Practice Aloud
o The words would be shown on the screen for 5 mins o You have to memorise these words by a practice aloud strategy: repeating the words with pronunciation of these words. This meant the student used more than one sense to memorise these words, speaking and hearing o Make sure everyone knew how to use this strategy
Written rehearsal
o The words would be shown on the screen for 5 mins. o You would be given a piece of papers for using in this

	strategy o You have to repeat the words then write them down more than one time on the paper
Self-test	
	o The words would be shown on the screen for 5 mins. o You would be given a piece of papers for using in this strategy o You have to read the words and quiz themselves more than once.

5.3.4 Training of Teachers

The participants were selected from 4 middle school adolescents, including 2 boys' schools and 2 girls' schools in Gizan. I had contacted the teachers using video teleconferencing so that they understood exactly how to explain the study's aims. A training workshop for both male and female teachers was then carried out so that they knew how to do the experiment in the class and collect the questionnaires. The researcher spent two weeks just explaining the aims of the study to principals, teachers, and adolescents. Furthermore, the researcher explained the experiment and the questionnaire instructions to teachers who were to apply these in schools. For the girls' schools, the researcher had a meeting with the principal and the teachers to explain all of the instructions. Different settings were used for receiving responses in the girls' school so that they could present their viewpoints clearly with ease and without any hesitation. Female adolescents are more comfortable with presenting their views to someone they already know; therefore, teachers were assigned and helped in conducting the experimental part and collecting the questionnaire.

The researcher was directly involved with participants in boys' schools while teachers were involved in the girls' school; therefore, the questionnaire was collected the next day after distribution in the girls' school due to the indirect involvement of the researcher. Due to cultural issues, I was not able to administer the experiment and the questionnaires to girl adolescents and adolescents may be more comfortable with their teachers than someone they do not know, therefore, I used gatekeepers, being the teachers themselves.

5.3.5 Procedure

The researcher approached the third graders in the intermediate schools in the GIZAN area of Saudi Arabia, and their consent was taken. After receiving the consent sheet papers from parents, adolescents, and principals during the second week, the researcher determined that data collection would start on Sunday 11 March 2018 at 9:00 AM for the boys' schools and Sunday 25 March 2018 at 9:00 AM for the girls' school. The experiment and questionnaire were administered in schools by teachers in a separate classroom. The selected adolescents were divided into four groups, including one group as a control group and three groups as an intervention. In session 1, adolescents were given 7 minutes, including 2 minutes for instruction and 5 minutes to recall a word. Participants were asked to memorise a list of 16 words presented sequentially (in random order). The researcher used words, including Amphibian, Insect, Tadpole, Caterpillar, Frog, Chrysalis, Toad, and Butterfly. A list of words was prepared by the researcher so that the same list was used in both the control and experimental groups. All the words were related to biology to add a little bit of complexity in the words.

The questionnaire and list of words were prepared with the help of five teachers who teach adolescents at Gizan University and have adequate experience in their field. A

computer was used to display the list of words and all adolescents were gathered in a computer lab equipped with 30 computers.

After reading the words, they were allowed 2 minutes to memorise them and instructed to use a particular memory strategy (Gaskill *et al.,* 2004). Further sessions incorporated a memory test, wherein adolescents were given adequate time to recall a word they had learnt using four different memory strategies of self-test, practice aloud, mental practice and written rehearsal. In order to remove the ordering effect of the type of memory strategy, the adolescents were divided into 3 groups incorporating 30 adolescents participating in group 1, 29 respondents recruited for group 2, and 31 respondents participating in group 3.

The second day started with a memory test by recalling as many of the 16 presented words as possible which they had seen on the first day, with 5 minutes for the test and 6 minutes to answer the questions. In session 2 which started a week later, the first group of adolescents were asked to take 7 minutes, 2 minutes for instruction and 5 minutes for showing the words and practising (list of words and type of memory training were selected by random order). After an hour the second group started, and they used the same steps as used with the first group. On the second day of this session, the adolescents were asked to do a memory test for 5 minutes. In sessions three, four and five the same procedure as in session two was used, but the difference was in the type of memory strategy that was practised. In session 6, the participants were asked to repeat session 1 after they had learned the words. The number of correct responses was used as a measure of their performance. The correct response of the participant was considered as their measure of performance for the memory strategy. The adolescents were given 1 point for each correctly recalled word and 0 points for wrongly remembered words. The adolescents were given one point for each correctly recalled word, with a maximum of 16 points. Thus, there were six actual performance scores, with a

maximum of 16 points each, for each student.

Session 1	Instructions	Practice Strategy	Show words	Memory test	Questionnaire
Week 1/ day 1	2 mins	N/A	5 mins	N/A	N/A
Day 2	N/A	N/A	N/A	5 mins	5 mins
Session 2	**Instructions**	**Practice Strategy**	**Show words**	**Memory test**	**Questionnaire**
Week 2/ day 1	2 mins	Mental Practice 5 mins	5 mins	N/A	N/A
Day 2	N/A	N/A	N/A	5 mins	N/A
Session 3	**Instructions**	**Practice Strategy**	**Show words**	**Memory test**	**Questionnaire**
Week 3/day 1	2 mins	Practice aloud 5 mins	5 mins	N/A	N/A
Day 2	N/A	N/A	N/A	5 mins	N/A

Figure 5.1: Observations from the classroom

5.3.6 Ethical issues

Before initiating the study, DBS approval was facilitated through the University of Lincoln. The reason for facilitating DBS has been explained earlier in Chapter 4. Further, consent was also obtained from the Ministry of Education, the school authorities and parents. The adolescents were given written information about the project in advance, including the right to withdraw and how to withdraw their data. Participants including male and female and adolescents were identified by a participant code number. No names or other personal identifiers were recorded on the memory test sheets. Participants were asked to give information freely. Any sign of the participant wishing to withdraw was noted and acted upon (e.g., asked whether the participant was comfortable, wished to continue, or wished to withdraw from the study). Participants were made aware of their right to withdraw their

participation or data from the study. Data could be withdrawn up to two weeks after the final testing had been carried out by contacting the researcher through the school and providing the participant code number. The researcher obtained permission for researching with adolescents through UK DBS clearance. At the end of the memory test a debrief form was sent to their personal e-mail. The debrief contained the participant's unique number, a brief explanation of the study, a thank you message for their participation and the researcher's e-mail in case they wanted to withdraw their data.

5.4 Results

5.4.1 Analysis of Qualitative Data

Content Analysis

In this study content analysis was undertaken to investigate and analyse the qualitative data gathered with the help of questionnaires conducted with 120 participants, to examine the memory strategies used by adolescents to learn their lessons. The questionnaire for both the control group and the experimental group consisted of 3 questions, each based on age, gender, manner of memorising, type of memory strategy and the reason for using them.

In this respect, the content analysis for the two categories of participants, the control group and the experimental group, was conducted in two parts for the two categories respectively. However, the analysis for both categories was undertaken in the same manner wherein the responses gathered from the participants were analysed by re-reading the transcripts multiple times and identifying the key categories. Following this, keywords were identified from the response transcripts from session 1 (pre-test) and session 5 (post-test) for the control group and session 1 (pre-test) and session 5 (post-test) for the intervention group. Based on the responses, the frequency of the responses was identified and compared between session 1 (pre-test) and session 5 (post-test) for the control group and session 1(pre-test) and

session 5 (post-test) for the intervention group to draw meaningful interpretations. The identification of the categories and coding categories, their frequency, and coding of data is followed by a brief discussion.

Contents Analysis for the Control Group

Table 5.3 *Identifying Themes and Keyword for Content Analysis (session 1(pre-test)*

Questions	**Category**	**Keywords**	**Frequency**
How normally memorise new information?	session 1(pre-test)	Writing more than one time	2
		Reading	3
		No specific strategy	1
		Linking to real life	1
		Keeping information well	1
		Use IQ	1
		Memorising	2
		According to the type of information	1
		Remembering	5
Which type of memory strategy used?	session 1(pre-test)	Own strategy	1
		No specific strategy	6
		Retrieving word forms	1
		Self-test	2
		Practice aloud	3
		Written rehearsal	3
		Reading	1
Why used that particular approach to memorise these words?	session 1(pre-test)	Help understand more	3
		For IQ	2
		Help remember faster	4
		Easy	8

Table 5.4 *Identifying Themes and Keyword for Content Analysis (session 5 (post-test)*

Theme	Category	Keywords	Frequency
How normally memorise new information	session 5(post-test)	Best way	1
		Saving information	1
		Linking to real life	2
		Easy way	8
		Memorising new words	3
		By using own ability and IQ	1
		Practising	1
Which type of memory strategy used?	Session 5(post-test)	No specific method	8
		Reading and writing	3
		Memorising	4
		Familiar words	2
Why used that particular approach to memorise these words?	Session 5(post-test)	Do not have a specific method	1
		Helpful in remembering	4
		Easy	5
		Increase ability and IQ	7

Coding the Data collected from Control Group

From the above tables, the most frequently reported works by the participants (words used more than 2 times) were chosen and coded as letters A to P. The frequency of reporting these words by the respondents was calculated and compared for session1 (pre-test) and

session 5(post-test) groups. The labels were determined on the basis of the words where frequency was more than twice in the session 1(pre-test).

Table 5.5 *Comparison of Frequency of Keywords in Pre-test and Post-test*

Keywords	**Labels**	**Session 1**(pre-test)	**Session5**(post-test)
Linking to real life	A	1	2
Easy way	B	8	13
Memorising new words	C	0	3
No specific method	D	7	9
Reading and writing	E	0	3
Memorising	F	2	7
Familiar words	G	0	2
Helpful in remembering	H	4	4
Increase ability and IQ	I	3	8
Writing more than one time	J	7	0
Remembering	K	5	0
Writing rehearsal	L	5	0
Self-test	M	2	0
Practice aloud	N	6	1
Reading	O	4	0
Help understand more	P	3	0

Type of Memory Strategy used by the Participants

Based on the examination of the themes and keywords for the content analysis, it was identified that 17 adolescents of the control group completed the questionnaire, and the

majority of the adolescents used strategies such as remembering, reading, memorising and writing more than one time, as the most suitable approaches to memorise words in session1 (pre-test). For instance, Respondent 17 states *'Memorising these words and remembering was a normal way of memorising new information'*. On the other hand, in session 5(post-test), a wider range of diverse ways was used by the adolescents as strategies to learn words. These included easy ways, memorising and linking to real life. Respondent 3, in this regard, states, *'By linking with my real life'.* Variability can be observed in the responses of the students as different students have different ability to memorise a word, for which they may find different strategies as suitable for them while memorising the words.

Adolescents' Approach to Memorising new Information

In the context of the adolescents' approach to memorise new information among the control group participants in session 1(pre-test), it was found that the majority of adolescents did not use a specific strategy, practising aloud or written rehearsal. As respondent 11 states, *'No specific strategy for remembering based on the kind of information'*. Reading and own strategy were found to be very rare approaches to learning. Further, in session 5(post-test), it was found that the majority of adolescents preferred not to use any specific strategy, or used memorising, or reading and writing. In this regard, Respondent 14 states*, 'Some strategies exist in our lives (no specific strategy)'.*

Reason of Using Particular Approach to Memorize Words

The majority of the adolescents in the session 1(pre-test) control group were found to be identifying the use of a particular approach because it was easy, helped them remember faster or helped them understand more. However, in session 5(post-test) the adolescents in the control group believed that they used a particular approach to memorise words because it

increased their abilities and IQ, or because they were easy and helpful for remembering. In this regard, respondent 5 states after the training, *'To increase my ability and my IQ'*.

Contents Analysis for the Experiment Group

Table 5.6 *Identifying Themes and Keywords for Content Analysis (Session 1(pre-test)*

Theme	**Category**	**Keywords**	**Frequency**
How normally memorise new information?	Session 1(pre-test)	Keep information in mind	2
		Reading	4
		Repeat	15
		Looking for similarity	4
		Understanding the meaning	3
		Meditation	3
		Saving	5
		Mental practice	5
		Remember forms	5
		Practice aloud	9
		Looking at it	1
		Self-test	1
		Written rehearsal	10
		Linking with something	3
		Imagination	1
		Focus	1
		Different ways	1
		Easily	1
		Easy way	1
		Thinking	1
		Use it	1
Which type of memory strategy used?	Session	Reviewing	2

	1(pre-test)		
		Link words	4
		Meditation	2
		Use left hand	1
		Looking for similarity	5
		Mental practice	11
		Analysis	1
		Remember	3
		Practice aloud	9
		Saving	3
		Repeating	8
		Writing	8
		Self-test	4
		Written rehearsal	10
		No specific strategy	1
		Understanding	1
		Good thinking	1
		Practice	2
Why used that particular approach to memorise these words?	Session 1(pre-test)	Improve memory	1
		Understand words	2
		Remember words	8
		Helpful	7
		Suitable	7
		Best way	3
		Saving	13
		Use it a lot	6
		More active	1
		Easy	15

		Relaxing	2
		Recall	4
		No reason	2
		Copying in mind	2
		Prefer it	1
		Beneficial	1
		Comfortable	1
		The best	3
		Faster	1

Table 5.7 *Identifying Themes and Keyword for Content Analysis session 5(post-test)*

Theme	**Category**	**Keywords**	**Frequency**
How do you normally memorise new information?	Session 5(post-test)	Practice aloud	5
		Mental practice	2
		Repeating	23
		Easy way	5
		Reading	6
		Writing	17
		Written rehearsal	4
		Understand the meaning	2
		Reviewing	2
		Saving words	4
		Keeping in my mind	1
		By thinking	6
Which type of memory strategy was use	Session 5(post-test)	Practice aloud	9
		Repeating	5
		Mental practice	10
		Reading	7
		Writing	8

		Written rehearsal	15
		Understand the meanir	1
		Reviewing	2
		No specific strategy	2
		Saving	2
		Self-test	6
		Test myself	2
		By thinking	5
		Looking	3
Why did you use that particular approach to memorise these words?	Session 5(post-test)	Helps recalling	1
		Avoid forgetting	2
		It easy	20
		Recalling	10
		Faster recalling	2
		Saving fast	1
		Saving	6
		Best	5
		Looking	3
		Understand	1
		Keeps the information my mind	4
		Saving words	6
		Feel comfortable	1
		Suits me	1
		Helps	10
		When I was child	4

Coding the Qualitative Data

Based on the most frequently reported words by the participants (words used more than twice), some words were chosen and coded as alphabets A to B1. The frequency of

reporting these words by the respondents was calculated and compared for session1 (pre-test) and session 5(post-test) experimental groups. The labels were determined on the basis of the words whose frequency was found more than twice in the session 1(pre-test).

Table 5.8 *Coding of Qualitative Data collected from in interviewing participants*

Keyword	Labels	Session 1(pre-test)	Session 5(post-test)
Best way	A	3	5
Copying in mind	B	2	0
Easy	C	20	37
Helpful	D	1	0
Keep information on mind	E	2	4
Link words	F	7	0
Linking with something	G	3	0
Looking for similarity	H	5	6
Meditation	I	5	0
Mental practice	J	21	15
No reason	K	2	0
No specific strategy	L	3	2
Practice	M	2	0
Practice aloud	N	25	15
Reading	O	4	11
Recall	P	4	16
Relaxing	Q	2	0
Remember	R	18	0
Repeating	S	8	29
Reviewing	T	2	3
Saving	U	21	26
Self-test	V	5	6

Suitable	W	7	0
Best	X	8	5
Understanding	Y	7	4
Use it a lot	Z	6	0
Writing	A1	8	16
Written rehearsal	B1	25	22

Type of Memory Strategy used by the Participants

By examination of content analysis for the 4 groups of adolescents forming the experimental groups, it was found that the majority of the adolescents used a repeat strategy, followed by written rehearsal, practice aloud, mental practice and remember forms as key memory strategies in session 1(pre-test). However, in session 5(post-test), the adolescents found repeat, writing strategy and written rehearsal to be more suitable. The findings suggest that repeating strategies continue to be a preferred strategy for adolescents, irrespective of training. As respondent 2 from session 5(post-test) states, *'By repeating the words more than one time with written'*. Nevertheless, a closer analysis revealed that in session1 (pre-test) a repeat strategy was used 8 times, while after the training, its frequency increased to 29, suggesting an increased inclination towards it.

Student's Approach to Memorise new Information

The findings further highlighted that the adolescents preferred to use practice aloud and written rehearsal strategies mostly as useful approaches to memorise new information in session1 (pre-test). Other preferred strategies were identified to be writing, repeating, mental practice and linking words. While after the training, it was found that the majority of the adolescents preferred written rehearsal, mental practice, practice aloud, and self-test as useful strategies. For instance, from session1 (pre-test) participant 34 states, *'Remember, Practice*

aloud, Scratch my finger (mental practice), Meditation (mental practice)'. It can be noted that session 5(post-test) adolescents did not use linking words and repeating but used more organised strategies to learn.

Reason of Using Particular Approach to Memorise Words

It was further found from the content analysis that before the survey the adolescents preferred to use a specific strategy because it was easy, or allowed saving words, remembering words and was helpful. On the other hand, by session 5(post-test) the adolescents believed in following a particular approach because it was helpful, allowed recalling, saving words and were easy. It was found that while 20 adolescents from session1(pre-test) preferred strategies for memorising words because they were easy, in session 5(post-test) 37 adolescents believed that strategies to memorise information were easy. For instance, respondent 2 from session5 (post-test) states, *'Because it is the easy way for recalling'*.

5.4.2 Analysis of Quantitative Data

ANOVA Test for 1 Session for each Group

In this ANOVA test is performed to compare the means of 3 groups used in 1 session**.** This study aimed to examine the number of words remembered by 3 groups of students using different memory strategies without any ordering effect.

Table 5.9 *Descriptive Statistics for 3 Groups*

Descriptives							
Number of words remembered in the First Memory Strategy tested							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum	Between-Component Variance

					Lower Bound	Upper Bound			
Practice Aloud (Group 1)		30	12.7667	3.47090	.63370	11.4706	14.0627	5.00	16.00	
Mental Practice (Group 2)		29	15.4138	1.82282	.33849	14.7204	16.1072	11.00	22.00	
Written Rehearsal (Group 3)		31	13.9032	2.15027	.38620	13.1145	14.6920	10.00	16.00	
Total		90	14.0111	2.77426	.29243	13.4301	14.5922	5.00	22.00	
Model	Fixed Effects			2.58446	.27243	13.4696	14.5526			
	Random Effects				.76004	10.7409	17.2813			1.50921

Table 5.9 shows that the students were divided into 3 groups on the basis of type of memory strategy used. The group 1 students used the strategy of practice aloud. Group 2 students used mental practice strategy while group 3 students used the strategy of rehearsal to remember 16 words that were given to them.

The table shows that mean value of mental practice (group 3) is highest (15.413), indicating that maximum number of students used mental practice strategy to remember the words. It shows that mental practice memory strategy is most effective among students.

Table 5.10 *ANOVA Test Number of words remembered in the First Memory Strategy tested*

ANOVA

Number of words remembered in the First Memory Strategy tested

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	103.878	2	51.939	7.776	.001
Within Groups	581.111	87	6.679		
Total	684.989	89			

Table 5.10 shows that the ANOVA test for number of words remembered by students and the 3 types of memory strategies used is statistically significant. It shows that the null hypothesis for this test is rejected showing difference in the mean for these 3 groups and now to get a detailed view on the groups showing major differences in their means post hoc test is applied.

Table 5.10.1 *Post Hoc Test*

Multiple Comparisons						
Dependent Variable: Number of words remembered in the First Memory Strategy tested						
Bonferroni						
					95% Confidence Interval	
(I) First Memory Strategy tested	(J) First Memory Strategy tested	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Practice Aloud (Group 1)	Mental Practice (Group 2)	-2.64713*	.67303	.001	-4.2901	-1.0042
	Written Rehearsal (Group 3)	-1.13656	.66190	.269	-2.7524	.4792
Mental Practice (Group 2)	Practice Aloud (Group 1)	2.64713*	.67303	.001	1.0042	4.2901
	Written Rehearsal (Group 3)	1.51057	.66768	.078	-.1193	3.1405
Written Rehearsal (Group 3)	Practice Aloud (Group 1)	1.13656	.66190	.269	-.4792	2.7524
	Mental Practice (Group 2)	-1.51057	.66768	.078	-3.1405	.1193
*. The mean difference is significant at the 0.05 level.						

It can be inferred from the table 5.10.1 that there is statistical significant difference between practice aloud and mental practice. It shows that mental practice and practice aloud shows difference between their means.

Thus overall it can be in freed from the analysis that mental practice is the most effective memory strategy used by majority of students and there is difference in the mean of all the three types of memory strategies used by students.

An ANOVA test with repeated measures was utilised in the current study as the same type of entities were used in the experiment. Repeated measure ANOVA is a suitable test statistic for comparing the mean of one multiple variable with repeated observations. This study aimed to examine the effectiveness of four different types of memory strategies for adolescents to recognise a word correctly. For this purpose, the total number of study participants was divided into three groups and all the three groups utilised four types of memory strategies, namely mental practice, practice aloud, self-test, and rehearsal but in a different order. However, any significant difference scores of participants on a memory test were tested using a repeated measure ANOVA. The outcomes of repeated measure ANOVA are presented as follows:

The difference in student scores practising four different Memory Strategies

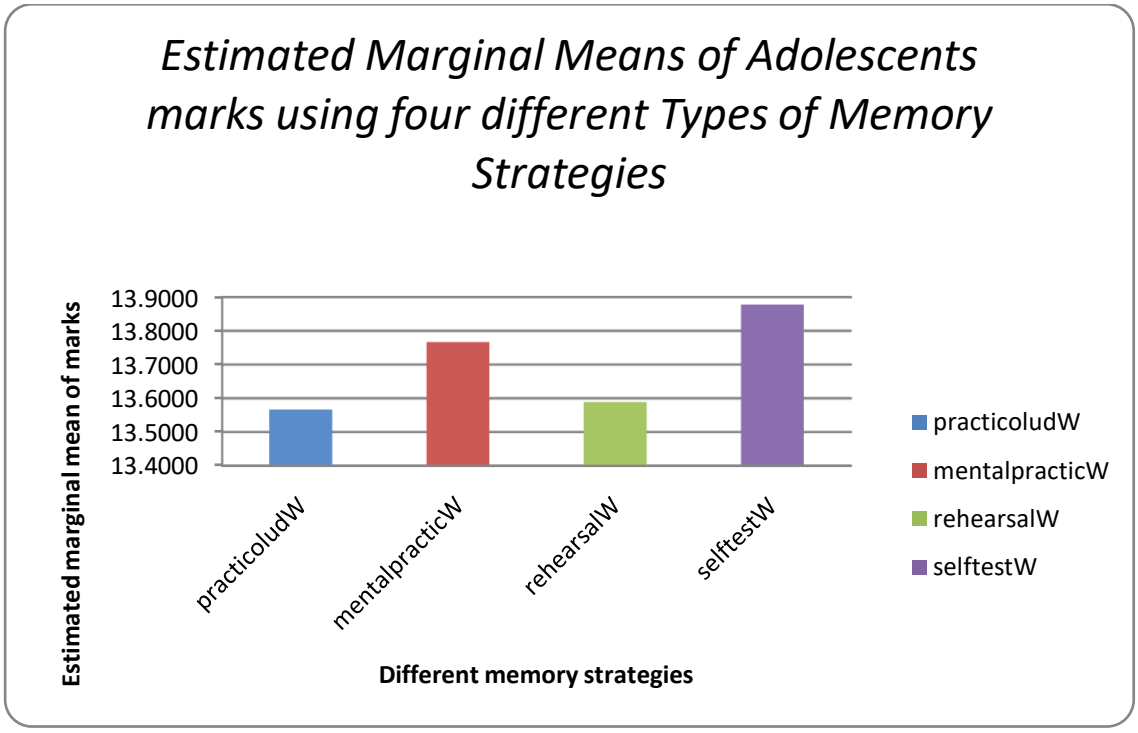
A within-subject effect is calculated with the help of ANOVA with repeated measures (Refer Table 4 in Appendix of Study 4). Before discussing the within-subject effects of within-subject factors in ANOVA with repeated measures, it is vital to test whether data follows the assumption of sphericity or not (Cardinal & Aitken, 2013). The assumption of sphericity is met when the variance of the difference between all combinations of related groups is found to be equal; otherwise, the data violate the assumption of sphericity (Levine, 2013). The violation of the assumption of sphericity is too critical for the repeated measure ANOVA, as it increases the rate of Type 1 error (Leech, Barrett, & Morgan, 2013). In such a scenario, where the data violate the assumption of sphericity, two corrections are used to produce a more a critical F-value, namely Greenhouse-Geisser correction and Huynh-Feldt correction. These corrections adjust the degrees of freedom of F-distribution in case the data violate the assumption of sphericity and help to provide a more valid result (Allen, Bennett & Heritage, 2014).

Mauchly's Test of Sphericity is used in the current study to test the null hypothesis that the variances of the differences are equal. The results of Mauchly's Test of Sphericity highlighted that the assumption of sphericity had been violated, $\chi 2(5) = 18.35$, $p = .003<0.05$. Since, $p< .05$; thus, data provide evidence for the rejection of the null hypothesis that the variances of the differences are equal. Table 2 in appendix, shows that the epsilon values are .90 and .93, which are both greater than .75; thus, it is better to use Huynh-Feldt correction as per the criterion defined above.

As discussed above, the assumption of sphericity has been violated; hence, standard corrected results are used to describe the results of repeated measures ANOVA. Table 3 in appendix indicates that the one-way repeated measures ANOVA examining the impact of different memory strategies that were used (practice aloud, mental practice, written rehearsal and self test) on the number of words remembered was not statistically significantly different (F (2.792, 248.47) = .472, $p = 0.688>0.05$, $\eta 2p = .005$). Since the mean scores of the adolescents on the memory test are not statistically significant, it is not required to proceed with the post hoc results.Figure 5.2 represents the outcomes of descriptive statistics regarding the estimated marginal means of adolescents' marks using four different types of memory strategies. The total number of 90 participants was divided into three groups having different order of memory strategies: group 1(practice aloud, mental practice, written rehearsal and self test), group 2(mental practice, written rehearsal, practice aloud and self test), and group 3. Group 1 included a total of 30 respondents, group 2 included a total number of 29 respondents, and group 3 included a total number of 31 respondents. The results reflect that the marginal mean arrived for the use of practice aloud W strategy was 13.56, which is the lowest. Reflecting that this strategy is least used by respondents, in comparison to the other three strategies of mental practice W, self-test W, and rehearsal W. The marginal mean

obtained was based on a review of the adolescents for rehearsal W memory strategy which at 13.5888 was marginally higher than that of practice aloud W strategy.

Figure 5.2 *Estimated Marginal Means of Adolescents marks using four different Types of Memory Strategies*



Further, it is evident from Figure 5.2 that the mental practice W strategy was ranked second by the adolescents, as this strategy earned a marginal mean score of 13.76 that is higher than the marginal means of adolescents marks obtained for practice aloud W and rehearsal W memory strategies. Further, a review of Figure 5.2 reflects that the marginal mean of students' marks was highest for the use of the self-test W strategy where the marginal mean marks were 13.9. In this aspect, it is clear that adolescents' reviews and marks reflect that although all four memory strategies are effective in making improvements in their performance level, however they prefer to use self-test W, which has the most effective memory-building strategy over the other three memory building strategies of practice aloud W strategy, rehearsal W strategy and the mental practice W strategy. Arranging the estimated

marginal means of adolescents' marks for all the four memory developing strategies, it is evident that self-test W is the most effective strategy, followed by mental practice W strategy, rehearsal W strategy and practice aloud W strategy; these reflect the results from adolescents studying at schools in the Kingdom of Saudi Arabia.

Impact of Ordering on Practising Memory Strategies so as to find out whether the different orders of practising memory have different results or not and which order is more efficient among all.

Table 5.11 *Descriptive Statistics of Ordering Effects*

Descriptive Statistics

	Group 1(practice aloud, mental practice, written rehearsal, self-test) Group 2 (mental practice, written rehearsal, practice aloud, self-test)	Mean	Std. Deviation	N
Practice loud W	Group 1	12.76	3.47	30
	Group 2	14.44	1.76	29
	Group 3	13.51	2.77	31
	Total	13.56	2.82	90
Mental practice W	Group 1	11.53	2.62	30
	Group 2	15.41	1.82	29
	Group 3	14.38	2.06	31
	Total	13.76	2.72	90

Rehearsal W	Group 1	12.93	2.21	30
	Group 2	13.93	2.26	29
	Group 3	13.90	2.15	31
	Total	13.58	2.23	90
Self-test W	Group 1	14.00	1.57	30
	Group 2	14.17	2.26	29
	Group 3	13.48	3.53	31
	Total	13.87	2.59	90

Table 5.11 represents the outcomes of descriptive statistics regarding the number of participants in group 1, group 2, and group 3. A total of 90 respondents participated in the study and were divided into three groups in almost equal proportion, as 30 respondents participated in group 1, 29 respondents participated in group 2, and 31 respondents participated in group 3. All these 3 groups related to the different order of tests that were completed in the study. A total of the mean score of the participants who practised different memory strategies was calculated. It was analysed from the above table that mean score was highest for self-test (M=13.87, SD=2.59), and the mean score was lowest for the participants who used the practice aloud strategy. Thus, it can be determined from the table of descriptive statistics that the majority of the respondents found self-test the most effective memory strategy to memorise information among the sample of adolescent selected from third grader adolescents in KSA.

Impact of the order effects

Table 6 in appendix demonstrates the outcomes of within-subject effects for 2*4 ANOVA with regard to the order effects. Since the assumption of sphericity was not fulfilled and epsilon >0.75; thus, Huynh-Feldt correction was considered. It is observed from the results of table 6 that the mean difference is not significant for the 3 different memory strategies as F (2.761, 991.89) = 1.93, p = 0.129> 0.05, $\eta 2p$ = .022. On the other hand, it is also identified from the results shown in the table below that interaction of type of memory strategy and group effect is significant at 5% level of significance as F (2.761, 991.89) = 11.54, $\eta 2p$ = .116, p<.001 < 0.05).Table 7 in appendix shows that the outcomes for between-subject effects is presented and It has been analysed that the F (1, 88) =10.96, p=.00<0.05. Thus, it can be inferred from the test results that there is a significant difference in the mean scores of participants for memorising a word in group 1, group 2, and group 3.Table 5.11 also shows the post-hoc of the difference in the mean scores of the respondents in group 1, group 2, and group 3. It has been identified from the results that there exist a significant difference in group 1 and group 2 ((I-J)=-1.6830, p = .002< 0.05). On the other hand, difference between the scores of group 1 and group 3, and group 2 and group 3 is not statistically significant at 5% level of significance.

Post hoc tests for interaction between order and strategy

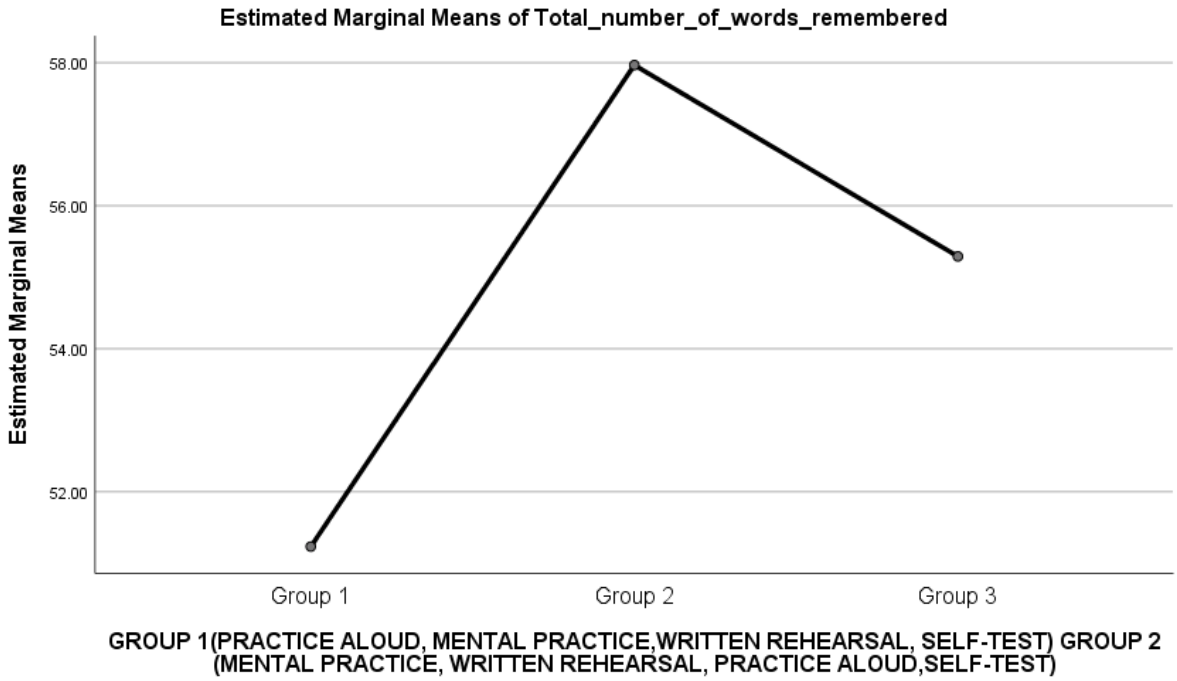
It has been analysed from the table 5.11.1 that there is a significant main effect of strategy in group 1 F (3, 87) = 7.09, η2p = .196, p<.000< 0.05. In addition to this, the results also describe that there is a significant effect of strategy in group 2F (3, 84) = 3.28, η2p = .105, p<.025< 0.05. On the other hand, strategy is not significant in group 3. A post-hoc test is performed in table 5.11.2 to see the strategy differences in group 1, group 2, and group 3. It is identified that there is a significant difference in the score of participants in group 1 due to

strategy 2 and 3, 2 and 4, 3 and 4. Similarly, in group 2, there is a significant different in score of participants in group 2 due to strategy 2 and 3 and strategy 2 and 4.

Number of words remembered in group 1 vs group2, group 2 vs group 3 and group1 vs group3.

A post-hoc test has been performed in table 5.11.3 to analyse the difference in the number of words remembered in group 1, group 2, and group 3. Table 5.11.3 shows that number of words remembered in group 1 is significantly different from group 2, as (I-J) = -6.73, p = .001<0.05. Further, the table results also showed that number of words remembered in group 2 is significantly different from group 3(I-J) = -4.05, p= .030<0.05. However, the table results are not significantly different in group 2 and group 3 (I-J) =2.67, p= .153>0.05. The same findings can be reflected from the figure shown below.

Figure 5.3 *Estimated marginal means of total number of words remembered*



T-test to compare the adolescents score in Control and Intervention Group (Student behaviour to apply a new Strategy)

The Pre-test scores of paired sample test were slightly higher (M=14.45, SD=1.91) as compared to post-test scores (M=14.40, SD=2.13). The difference here is .041, 95% CI [-.27, .36] and is not considered as statistically significant since t (119) = .258, p> 0.05. Moreover, table 5.11 indicates that no significant difference in the scores of the control and intervention groups.

The difference between Male and Females in effectiveness of Memory

Table 5.12 shows that the main output of ANOVA, the assumption of sphericity has been fulfilled so that the standard ANOVA results can be utilised to interpret the outcomes in the table. It has been analysed from the results that there is a non-significant main effect of Pre-post as F (1, 11) = .865, p = 0.35> 0.05, η2p = .007. The results show that main effect of male and female is not significant. It is also analysed from the table outcomes that the interaction of pre-post and gender is also non-significant as F (1, 11) = .177, p = 0.674> 0.05, η2p = .002. Further, the interaction of test (pre, post) and group (control, intervention) is non-significant F (1, 116) = 3.11, p = 0.08> 0.05, η2p = .02. The results of Table 5.12 highlights that interaction of pre-post, gender, control or intervention is non-significant as F (1, 116) = 1.805, p = 0.182> 0.05, η2p = .015. There is no significant main effect and interaction effect so the pairwise comparison is not performed.

Table 5.13 *Group Statistics*

STUDENT-GENDER	N	Mean	Std. Deviation

Practice aloud	MALE	60	13.97	2.37
	FEMALE	30	12.78	3.47
Mental practice	MALE	60	14.88	2.00
	FEMALE	30	11.53	2.62
Rehearsal W	MALE	60	13.92	2.19
	FEMALE	30	12.93	2.21
Self-test	MALE	60	13.82	2.99
	FEMALE	30	14.00	1.576

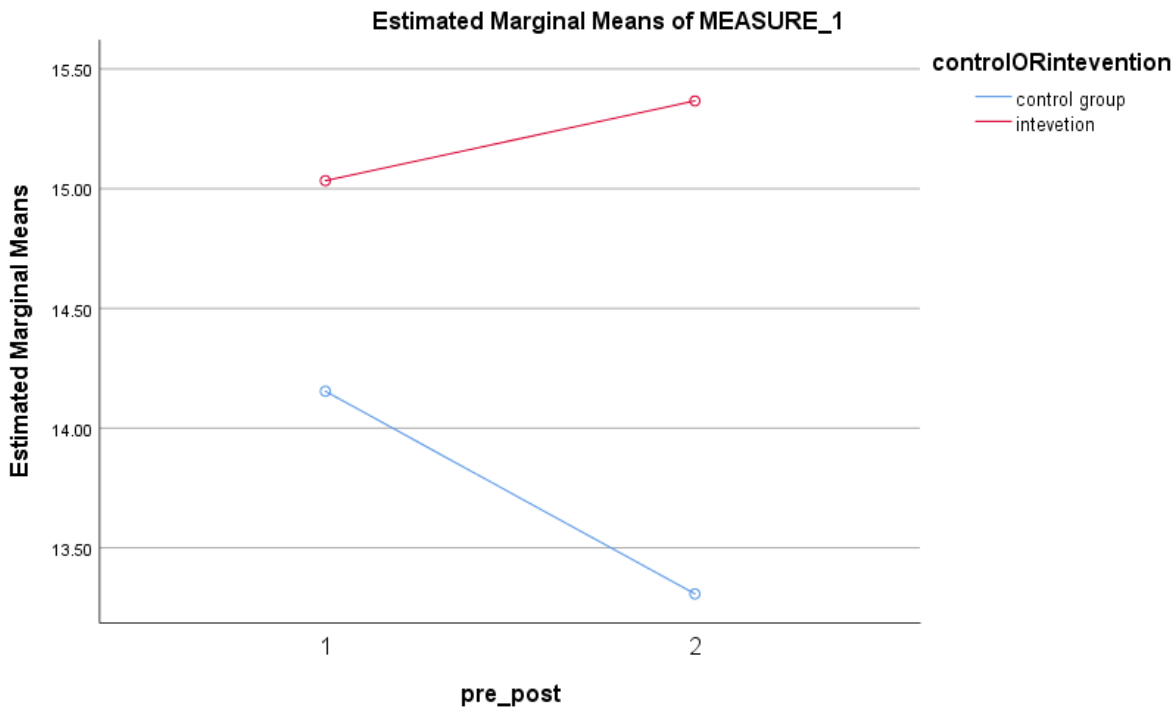
Table 5.13 shows that the difference in the mean scores of males and females in memory strategy was highest for mental practice. The average scores of males (M=14.88, SD=2.00) was higher than the average scores for females (M= 11.53, SD=2.62). The difference in the average scores of males and females is statistically significant at 95% CI as t (88) =6.733, p< 0.0. Also, the table 11 in appendix indicates that there is a significant difference in the scores of male and female participants who have used mental practice.

Differences between Males and Females before and after test

Table 5.12 shows that there was no statistically significant interaction between the within-subjects factor pre-post and gender as F (1, 116) = 0.177, p>.05, partial η2 = .002. On the other hand, table 5.13 shows that there is a statistically significant interaction between the within-subjects factors pre, post and control OR intervention in females as F (1, 41) = 6.957, p <.05, partial η2 = .145. Post-hoc tests showed that females' post-test scores were

statistically lower than their pre-test scores in the control condition but not in the intervention condition. The graph below shows this pattern.

Figure 5.4 *Estimated Marginal Means of MEASURE 1*



5.5 Discussion

5.5.1 Summary of Study Findings

The adolescents in the questionnaire analysis described a number of techniques that they use to remember information, such as reading, writing, reviewing, linking and repeating. The findings of the questionnaire responses further highlighted that from the post-training phase in the experimental group, the adolescents identified recall, repeating, saving words, writing, and easy strategies more effective for memorising than in the pre-training phase.. This highlights that these strategies might not be as significant for the adolescents to memorise words, apart from self-test. Further, it is also found from the study findings that average scores of adolescents utilising different memory strategies do not vary on a memory test, while findings also depicted that there exists a significant difference in the control group

and time point 1 and time point 2. The reason behind the difference in frequency of adolescents using different memory strategies is that the selection of a memory strategy depends on a student's mental, cognitive, and psychological processes. The student may have different mental, emotional, and psychological states at different points of time, so they have chosen a different memory strategy in the pre-test and post-test phase. In a similar way, literature also suggests that recall of a word may depend on the emotional state and mood of an individual as a happy person may more easily recall the words related to happiness, and a sad person may recall the words related to depression and anxiety (Sutton *et al.*, 2010).

It was identified from the findings of the questionnaire that the majority of the adolescents preferred the use of written rehearsal and practice aloud to memorise new information in a pre-test. In addition to this, the other strategies preferred by the adolescents were mental practice, writing, mental practice, and linking of words. On the other hand, after providing a training of the memory strategies, the adolescents preferred the use of mental practice, written rehearsal, and practice aloud and self-test. It was also identified from the findings of the questionnaire that the participants used a specific set of strategies before training was provided to them, according to their own convenience and knowledge. After providing the training for a memory test, the majority of the participants acknowledged that using a memory strategy among the four different types was easy and helpful for them to memorise information.

It was identified from the results of the memory test that there was no significant difference in the pre-test and post-test scores of the adolescents' utilised different memory strategies. Thus, it can be discussed that memory strategies do not play a significant role for adolescents to memorise new information. On the other hand, it was analysed from the outcome of study 3 that memory strategy played a crucial role for the undergraduate adolescents to memorise new words. The method used in study 4 was found suitable and no

changes were made in the method except sample size and sample participants. Moreover, the study applied some very common memory strategies, and the majority of the adolescents were already using a combination of strategies before memory training; thus, no significant improvement in their scores post-training was identified.

It was analysed from the literature findings of Kinsella *et al*., (2016) that the authors who took a sample of early age group children found a significant impact of memory strategies on the performance of children in the early stages of their life (Kinsella *et al*., 2016). Previous researchers also found a positive impact from memory strategy on the performance of adolescents. However, the sample population was different in each case. So, it can be inferred that the impact of memory strategy among the adolescents is not the same for each age-group. In a similar regard, Halford (2014) described memory as a cognitive function, and the perception of individuals to use different memory strategies to memorise a word may also vary.

It was identified from the outcome of repeated measure ANOVA that the mean scores of the adolescents did not increase after providing them with training in memory strategies. The estimated marginal means of participants' scores were also presented with the help of a bar diagram that depicted that there did not exist a larger difference in the mean scores of the adolescents' scores. The minimum scores of adolescents corresponded to practice aloud (M= 8.975) and highest scores corresponded to self-test (M=11.775). However, the study findings also demonstrated that there was a significant difference in pre-test and post-test scores of females.

The difference in pre and post test score of females may be because of the more engagement of females in learning and then using the memory strategies as compared to males. Likewise, secondary findings also revealed a significant difference in the attitude of

males and females towards education and English language learning strategies. The authors have found that female adolescents have a more positive attitude towards English learning than male adolescents (Sabti & Chaichan, 2014).

Thus, the findings of the study reflect that no particular memory strategy is considered effective as compared to others, while the ordering effect was found to be significant, with a 95% confidence level.

It can be discussed from the findings of the first session in which the memory strategies are analysed without ordering effect that there exists significant difference between the 3 types of strategies used by students to remember the words. The test shows that the mean score of practice aloud was lowest indicating the lowest use of this strategy. Similar results have been obtained in other analysis where different memory strategies were tested in different orders; here also the mean score of practice aloud was lowest showing that students least preferred this strategy to remember the words. While the results obtained from memory strategies without ordering effect also show that mental practice is found to be most efficient memory strategy used by students for remembering the words assigned to them. The participants of group 2 using mental practice strategy remembered more words and it could be due to high effectiveness of mental practice strategy in remembering words as compared to other strategies.

From the study outcomes, it was found that there exists a significant difference in the scores of group 1, group 2, and group 3, who have utilised memory strategy in a different order. The ordering effect was analysed by comparing the performance of adolescents in three groups. One of the key reasons behind the difference in the adolescents' performance in different order groups may be different environmental conditions, which cannot be controlled by the researcher. Among the 3 groups in the study, the overall performance of group 2 (order

of strategies: Mental Practice, Written Rehearsal, Practice Aloud, Self-Test) was better than the other groups. The reason behind the enhanced performance of the study in this particular group may also be the effectiveness of the sequence of memory strategies. The different order of group 2 which is mental practice, written rehearsal, practice aloud and then self test is more effective as firstly the respondent has to do the mental practice this will help his find to get prepared mentally for the test and remember as much as he can. Then after mental practice the respondent will write down all that he remembers from the mental practice. After that whatever the respondent could not remember he will practice it aloud and then the self test will help him to examine how much he remembered totally. This is a better sequence than other sequences because in this way the brain remembers things more effectively. Thus, it can be inferred from the study findings that the order of memory applied to the adolescents of group 2 was proved to be most effective for memorising a word.

5.5.2 *Limitations and Future Work*

A number of limitations corresponding to the methods and limitations are presented in this section, which may direct future researchers to complete the study on a similar topic in an effective manner. A structured questionnaire was used by the researcher incorporating only three questions, which restricted the researcher to collect in-depth qualitative evidence. Further, the reliability and validity of the outcomes were also affected due to a large number of missing responses in regard to adolescents' scores in four different types of memory strategies. In order to overcome the issue, a future researcher should use a follow-up test for the questionnaire to ensure that all the questions are answered by the respondents. The current study incorporated 90 respondents in the experimental group, out of which 30 were females and 60 were male. Thus, the study failed to effectively capture the differences in the perception of male and participants in regard to a memory strategy. In this respect, a future researcher should recruit an equal proportion of male and female participants to analyse the

difference. This study utilised a list of words for the assessment of memory strategy, which was not effective enough to generalise the study outcomes. The focus of the study, in respect of examining of strategies for memorising was confined only to memorising of words. This restricted the scope of the research and made it highly limited. This study can thus be seen to be relevant only in the context of learning words and not any theory, concept or information and therefore its generalizability is highly limited. Thus, future researchers may use certain theories, facts, and subjective information to test the adolescents' capacity to memorise information beyond just words.

5.5.3 Conclusion

It can be concluded from the outcomes of this study that the sample of adolescents in KSA middle schools does not use a specific method to memorise new information. The most common memory strategies used by the respondents are repeating, thinking, the imagination of words, writing, and linking. However, the type of memory strategy used by the adolescents also changes with the type of information that they need to memorise. Thus, the memory strategies are utilised as per the convenience and knowledge of the respondents, and no particular memory strategy among the four strategies, including practice aloud, mental practice, and rehearsal, self-test, can be considered better, compared to others. The final chapter presents a discussion on how the results of these studies have achieved the objectives of this research.

Chapter 6: Discussion

6.1. Summary of Findings

This research study was undertaken to investigate the ways Saudi Arabian adolescents studying at the middle school level apply memory strategies. The study was directed towards examining the presence of a relationship among the memory strategies used by adolescents and grades achieved by adolescents, for identification of the most effective strategy for adolescents of Saudi Arabia. The importance of this strategy lies in initiating an investigation into the use of recent memory strategies in middle school adolescents (aged 15) of Saudi Arabia. In this aspect, it can be discussed that the results obtained from this study can play a constructive role in directing the adolescent show they must prepare for examinations. The overall findings of the respective studies along with adequate inferences have been mentioned below:

Study 1:

A simple linear regression analysis was used in study 1 to predict the adolescents' feelings of success after using a memory strategy by analysing their scores on different subjects such as English, Arabic, Quran, and Science. It was examined from the study findings that scores of adolescents in English were explained by a 2% variation in their feelings of success. The variation explained by the scores in the feelings of success was too low, which indicates that apart from the scores of adolescents, there were several other determinants which might affect the adolescents' feeling of success, such as their psychological and mental wellbeing.

It was also observed from the outcomes of study 1 that memory strategy was beneficial to recall information of the English Language subject, as adolescents had achieved higher scores in English due to the English test. It was explored from the regression analysis

that memory strategy was explained by a 6% variation in the score of adolescents in the English language. Further, the use of memory strategy and type of memory test were also found to be closely related to each other. The outcome of study 1 suggested that a self-test helped improve the long-term memory of the individuals as well as remembering important events and dates. Further, it was also explored from the previous studies that self-test was a beneficial method for language learning. Additionally, the outcomes of study 1 demonstrated that rehearsal was a beneficial strategy to increase the learning achievements of adolescents in the Arabic language.

Based on the survey results it was found that the effective use of memory strategies has successfully managed to improve scores in English language for a large number of adolescents, reflecting the presence of a positive relationship among adolescents' scores in English language and memory strategies. In support of this, a review of literature reflects that there exists a strong positive relationship between the academic performance of adolescents and memory strategies used for adolescents in Saudi Arabia (Katz, 2015).

It has been found from the analysis of survey results that many adolescents highlighted that the use of memory strategies of practising and self-testing was highly effective in enhancing learning skills and remembering. The use of self-test, rehearsal, practising, and mental practice were the four most common memory strategies used by the adolescents enrolled in schools in Saudi Arabia. Aligned with this aspect, it is discussed that the use of practice and self-test strategies were used by adolescents primarily while preparing for final exams as they are relatively easy to use and best for enhancing a remembering capacity.

It can be further discussed based on the survey results that the use of memory strategies is practised by adolescents in Saudi Arabia in varied forms, which include

narratives, written rehearsals, self-test, mental practice, and rhymes. The study findings reflect that there is a high correlation between memory strategies, namely mental practice, practice aloud, written rehearsal and self-test performance of adolescents, which suggests that memory strategies are critical for the adolescents. This study utilised correlation and regression analysis to analyse the relationship among the variables.

Overall, it can be inferred from the study findings in the light of literature that the use of memory strategies is a common practice for the middle schools operating in Saudi Arabia, as both teachers and adolescents have a strong belief that memory strategies are highly beneficial in enhancing their overall results. The use of mental practice, self-test, written rehearsal, and other memory strategies are considered highly productive among Saudi adolescents.

Study 2:

The second study was undertaken to examine the role of memory strategy in a student's learning as per the opinion of teachers. It was further focused on analysing the opinion and perspective of teachers about the role of memory strategies. Since teachers spend a significant proportion of time with the adolescents in a day, thus, they can provide sufficient information about the role of memory strategies in adolescents' learning. All the teachers participating in the study were from the same schools as the adolescents in study 1. The perception of teachers indicated that the teachers of intermediate schools in KSA are more likely influenced to motivate their adolescents to use strategies, such as the rehearsal, mental practice, and self-test as compared to the adolescents of other countries, such as the USA. The findings of study 2 also highlighted the opinion of teachers that memory strategy assists the adolescents in enhancing their recalling capability, which also helps the adolescents in increasing their academic achievements. The outcomes of study 2 also

reflected that memory strategies are easier to grasp and easier to use, which in turn help the adolescents to increase their academic scores.

The findings of study 2 highlighted that memory strategies were effective in developing capabilities of adolescents for varied subjects wherein the use of practising and self-testing strategies were commonly practised by adolescents. As per the opinions of the teachers who participated in this study, memory strategies and their implementation should always be given proper attention as these ultimately can contribute in the success of adolescents at the end of the academic year. It can be discussed that the ‘practising' memory strategy can prove to be useful for adolescents in the strengthening of the neural system, as it facilitates the movement of information and concepts from temporary working memory to long-term memory, thereby helping adolescents in enhancing their learning skills and gaining a better overview of entire concepts (Alqurashi, 2017).

Aligned with this, it is evident from the literature findings of ALshammari, (2015) that the use of the self-testing strategy is effective in the identification of key focus areas and knowledge for adolescents and thereby helps them in enhancing their learning skills. Self-testing practice facilitates a better comprehension of information as it establishes a strong relationship between initially acquired knowledge and new concepts (ALshammari, 2015). Therefore, it can be inferred that the responses and opinions of the teachers regarding the importance and effectiveness of memory strategies are indeed credible as this aligns with the literary findings.

It can be discussed from the findings of the interview that there exist positive implications in the use of memory strategies among adolescents in the schools of Saudi Arabia. The findings demonstrate that the awareness of the teachers, regarding the use of different memory strategies, has increased. The literature also supports that teachers in Saudi

Arabia are engaged in using different memory strategies that focus on enhancing the reading ability of adolescents in the schools. In addition to this, the literature supports that the focus on reading as a significant aspect of memory strategies is considered to impact positively on the learning ability of adolescents in Saudi Arabia. The significance of memory strategies has been considered crucial by the teachers in improving the effectiveness of the teaching process in Saudi Arabia (Gilakjani & Sabouri, 2016).

On the basis of the interview findings, it is discussed that memory is considered an essential part for the adolescent learners in the schools of Saudi Arabia. It is reflected from the findings that memory strategies have been adopted by the teachers in teaching adolescents in the middle schools of Saudi Arabia as it helps in improving their performance. This finding can be supported through the literature of Ghorbani & Riabi (2011) wherein it was identified that the use of effective memory strategies help teachers in improving student performance, specifically in subjects such as English (Ghorbani & Riabi, 2011). Further, the interview findings also reflected that the use of an effective memory strategy by teachers in Saudi Arabia helped in encouraging the adolescents to deliver improved performance. In this context, another study by Peng & Fuchs (2017) indicates that the involvement of teachers in the implementation of learning strategies helps in encouraging the learners to make use of strategies, including rehearsal and mental practices, which boost their learning ability (Peng & Fuchs, 2017). In this regard, it can be identified that memory strategies implementation can have a direct impact on the performance of adolescents and it drives their ability to revise or revisit the topics that are taught to them by the teachers.

It is revealed from the findings of the primary data that the teachers in Saudi Arabia are engaged in encouraging their adolescents towards the use of memory strategies, such as organisation, rehearsal, self-test, and mental practice for achieving improved performance of adolescents in the schools. In relation to this, Bada & Olusegun (2015) have supported that

the use of memory strategies by adolescents helps them in improving their learning ability. Further, the use of memory strategies also helps in improving the overall outcomes of the teaching process and positively impacts on the intellectual level of the adolescents (Bada & Olusegun, 2015). It is also noted on the basis of the findings of interview data that the implications of the memory strategies on the achievement level of the adolescents increases as a result of the increase in the use of effective learning approaches. It is supported by the literature findings of Kikas & Jogi, (2016) by reflecting that the increase in the adoption of effective learning strategies contributes to adding value to the effect of memory strategies on the achievements of adolescents. This helps in the designing of future education policies, which helps in the improvement of overall learning outcomes (Kikas & Jogi, 2016).

The findings further indicate that there are certain negative implications associated with the use of memory strategies by teachers in the schools of Saudi Arabia. Factors such as the teacher's knowledge about memory strategies and motivation provided by them to the adolescents may significantly affect memory strategy used by adolescents in the middle schools of Saudi Arabia. It is also supported by the literature findings of Liao & Lin (2016) that the background of the teachers determines the level of their efforts in the improvement of the learning ability of their adolescents. There are a few teachers who make limited efforts in the process of memory improvement of their adolescents, which influences their learning behaviour (Liao & Lin, 2016). Thus, a crucial effect of memory strategies on school adolescents, including adolescents in Saudi Arabia, is considered in terms of their learning behaviour, which is influenced by the limited efforts of the teachers in the process of implementation of memory strategies and improving the overall learning process.

On the other hand, the findings further reflect that teachers in Saudi Arabia encouraged their adolescents to use a self-test memory strategy. In addition to this, the findings also reveal that the teachers encouraged their adolescents to use memory strategies

as the teachers believed that these strategies were effective in terms of improving adolescents' performance, as these strategies helped the adolescents in recalling information. In this context, the literature supports that a combination of self-test and distributed practice is considered significant in terms of the improvement of the effectiveness of the learning ability of adolescents (Hartwig & Dunlosky, 2012). In addition to this, the literature also supports that the use of the self-test is considered an effective memory strategy that assists the language learning ability of adolescents in relation to the learning of foreign language (Panus*et al.*, 2014). Further, it is also demonstrated in the literature that self-testing has been identified as an effective measure for the improvement of a student's memory through the improvement of their ability to recall (Kikas & Jogi, 2016). Overall, it can be identified from the aforementioned discussions that self-testing is a useful memory strategy through which adolescents can evaluate their knowledge and memory ability. This can further assist in boosting the learning ability of different subjects, which is necessary to score well in academic life. In a general context, it can be depicted that memory strategies play a crucial role in boosting the learning ability and informational recalling ability of the adolescents. This finding can be applied to each and every student irrespective of their gender and country wherein they study.

It is discussed from the data findings that memory strategy plays a significant role in the process of student learning. In addition to this, the findings reflect that student achievement is a significant factor that is variable in terms of the learning process of the adolescents. It is observed that the teachers in Saudi Arabia encourage their adolescents to use an organisation memory strategy. Further, the literature supports that there is individual differentiation among adolescents in middle school in the context of memorisation. The teachers are engaged in motivating adolescents regarding the use of easy methods of recalling and remembering and avoid the use of complicated methods. The teachers suggest their

adolescents use rehearsal and self-test as significant methods for improving their learning process.

The literature associated with the findings also supports that teachers are engaged in motivating and encouraging adolescents towards using memory strategies. This helps in the achievement of effective learning outcomes and improving the overall process of student learning (Bada & Olusegun, 2015). Even though the population that was selected for study 2 comprised third grade middle school adolescents of Gizan, the results however are applicable to all the middle school adolescents that are studying in Saudi Arabia or elsewhere. Overall, it was identified that the use of memory strategies positively affects middle school adolescents who are engaged in learning in Saudi schools.

Study 3

Study 3 was focused on the examination of the effectiveness of memory strategies on a sample of adult Arab adolescents in the UK. This study utilised both the survey and interview method to examine the rationale of memory strategies to memorise new information. In study 3, data collected from the survey findings were evaluated through a statistical analysis technique. On the other hand, data collected through the interviews were analysed using a content analysis technique. It was identified from the study outcomes that memory strategy improved the background knowledge, motivation, engagement, and memorising capacity of the adolescents, which in turn helped them to quickly recall the content taught by the teachers. The study outcomes also showed that self-testing helped the adolescents to remember for the long term and helped them to test their knowledge about a subject. Further, study 4 was a large-scale study conducted among 120 adolescents of third-graders at intermediate schools in KSA to examine the memory behaviour of the adolescents

and to compare between four different types of memory strategies, including mental practice, practice aloud, written rehearsal and self-test.

The aim of study 3 was to determine which memory strategies were more useful for Arabian cultures. For this purpose, this study investigated the ways in which undergraduate adolescents memorised new information in normal circumstances, comparing the four different strategies, namely practice aloud, mental practice, written rehearsal and self-test and evaluating memory behaviour. The aim was firstly addressed through the content analysis of the interview conducted with the Arabian undergraduate adolescents studying at the University of Lincoln in England. From the findings of the content analysis conducted in study 3 for the examination of memory strategies on a sample of the adult population, it was analysed that reading and writing were practised in memorising new information. This tendency among the undergraduate adolescents was found to prevail irrespective of their gender. This finding can be supported through the study of Morehead *et al.* (2019), wherein the significance of note-taking, an important writing practice among the college adolescents, was identified. The findings of the study indicated that writing practice can help the adolescents in memorising their academic content in an effective manner. In fact, it was regarded as an influential means of boosting the information storage capacity of adolescents, which reading materials alone cannot do (Morehead *et al.*, 2019). This secondary study, in alignment with the findings of study 3, highlights the same argument that reading and writing can prove to be an effective means of boosting the information memorising ability of adolescents.

It was identified from the findings of statistical analysis that the means score of adolescents for recalling a word was significantly higher for those who utilised a memory strategy as compared to the mean scores of adolescents who did not use any specific type of memory strategy. In a similar regard, it was also identified that the self-test memory strategy

was more effective in increasing adolescents' scores in a vocabulary test. Moreover, the study findings also suggested that the adolescents utilising the modern approach of memory strategies gained more success in terms of learning and recalling new words, as compared to those who used the traditional approach of reading and writing (Sozler, 2012). Further, the survey findings examined from the pairwise comparison found the mean scores of adolescents using practice aloud was almost the same as the mean scores of participants using rehearsal. Apart from this, the mean scores of the participants utilising mental practice and rehearsal were also almost the same. On the other hand, results of descriptive statistics indicated that mean scores of the participants using self-test were significantly higher, as compared to marks of adolescents due to other memory strategies. In a similar regard, it was also analysed from the findings of secondary sources that the self-testing process helps in the significant improvement of academic performance of adolescents. Moreover, adolescents also think that the self-testing process helps them in increasing their interest and knowledge of the subject. Further, self-testing also develops a self-directional learning skill among adolescents, as they are motivated to judge their own performance through a self-grading tool (Goto Butler & Lee, 2010).

The findings of the content analysis in study 3 further revealed that before the training in memory strategies, the adolescents did not employ any specific or technical method to memorise new information. However, after the training, the adolescents revealed they found the self-test method to be highly effective and useful to memorise new information. These findings draw significant support from the prevailing literature. In this regard, the literature reveals that using appropriate study strategies by the adolescents helps in enhancing their test performance. The findings of the research conducted by Nist, Simpson and Hogrebe (1985) reveal that adolescents who followed suitable study strategies performed better in respect of the context than the ones who were exposed to the same strategies but did not consider them

useful to be applied during the learning process. The findings of the literature are evidenced by a strong correlation between the test scores and the number of positive outcomes in the results (Nist, Simpson & Hogrebe, 1985). The findings of the literature largely indicate that following effective learning strategies and applying them in realistic and practical contexts serve to be highly beneficial for adolescents in successful learning.

Study 4

Study 4 was a full-scale study that was conducted to analyse the significance of memory strategy for a sample of adolescents selected from the third-graders of intermediate schools in the KSA. In order to accomplish the research aim, a total of 120 adolescents aged 15 years were recruited from schools in the GIZAN area of the KSA. The research participants were divided into two groups, wherein 90 participants were recruited for the intervention group, and 30 were recruited for the control group. Furthermore, these 90 respondents were provided with training in four types of memory strategies, namely practice aloud, mental practice, written rehearsal, and self-test in different orders. In order to avoid the order issues, the participants of the intervention group were also divided into three groups. At the end of memory training, the effectiveness of memory strategy was tested with a survey and interview questionnaire that was distributed to 120 participants.

It was identified from the results of study 4 that there did not exist a significant difference in the pre-test and post-test scores of the adolescents who adopted four different memory strategies. The findings of study 4 reflected that memory strategies do not play an essential role for adolescents to recall a new word. In this regard, it was also identified from the outcome of study 4 that the sample of adolescents had already developed their memory strategy as per their choice and preference.

The results of study 4 depicted that there was a significant difference in the memory test score of the male and female participants. In this regard, it is recognised that a larger difference between the sample of male and female participants remained a prime reason for such results. On the other hand, secondary evidence supports the fact that female adolescents are more open to learning new strategies to enhance their knowledge base, as compared to male adolescents (Sabti & Chaichan, 2014). Another piece of evidence associated with a similar context studied by Akbarov (2015) indicates that female learners are identified as more dedicated to implementing new learning or memorising techniques, in comparison to the male population. It is so because they are more careful about putting their learning into practice, as a result of which females prefer memory boosting techniques even more than males (Akbarov, 2015). In this regard, it can be inferred that the responses acquired in study 4 did not show a significant difference in the academic performance of adolescents, mainly because of gender division.

It was also identified from the findings of the interview in study 4 that the majority of the adolescents were already using the four types of memory strategies in the form of reading, writing, rehearsing, and self-testing, but they were not aware of the name of the strategies. Thus, the memory strategies did not significantly influence adolescents' memory behaviour due to the inadequacy of the sample in study 4. It was also evaluated from the outcome of the repeated measure ANOVA in study 4 that the average score of the participants in the intervention group was not different to a greater extent in a memory test. In this regard, the study results highlighted that the selection of a particular memory strategy depends on the cognitive processing and intellectual level of the adolescents that differ between each student. In this respect, it was also found from the literature that correct recall of a previously memorised word may depend on the emotional or mental state of a person at that particular time (Riegel *et al.*, 2016). The findings of study 1 and 2 highlighted that there exists a

significant association in memory strategies and student grades. The reason behind this may be the differences in sample population, as study 1 incorporated a sample of third-graders of middle schools and study 2 included a sample of teachers. On the other hand, study 4 included a sample of adolescents; thus, the majority of the adolescents recruited in study 4 had already formed their memory behaviour. Further, the sample size was also less in study 3 as compared to study 4. There was also a difference in the methodologies of studies 1, 2 and 4. Study 1 utilised a survey method, wherein the scores of adolescents in different subjects were used to analyse the impact of memory strategies, while interviews were used in study 2. Further, study 4 utilised both survey and an interview questionnaire to analyse the impact of memory behaviour on student learning. Thus, the outcome of study 4 provides an enhanced picture of the research phenomenon.

It was identified from the plot of estimated marginal means that the marginal mean corresponding to self-test was higher compared to other tests; thus, it can be inferred that self-testing is most popular among adolescents to learn new information. The self-testing effect was one of the most interesting topics for improving the cognitive learning of undergraduate adolescents. In this regard, previous researchers have related self-testing to information retrieval and retention and found that these variables are positively related with each other. Further, researchers have also found that self-testing is a more effective tool as compared to practice aloud, written rehearsal, and mental practice, which helps in the long-term retention of information. A paired sample t-test was utilised in the study to analyse student behaviour to apply new information, and the findings suggested that adolescents were able to utilise the strategies they had learned. In support of this, it is observed that memory strategies can be used by adolescents in different ways. Memory strategies can be used to introduce a new concept or to remember the course material. On the other hand, memory strategies can also be used by the teachers to introduce a new concept that would help adolescents to retrieve

already known information. It can be reflected that the majority of the undergraduate adolescents use self-assessment or self-testing strategies to monitor their progress of learning.

Interpretation with other literature

The findings of study 1 primarily indicated that teachers in Saudi Arabia perceived that the application of memory strategies was essential for improving scores and ensuring the development of enhanced learning skills among adolescents. This can be supported by the existing literature from Al-Bidawi (2018) and Alqurashi (2018), wherein it was identified that memory strategies are considered highly effective in ensuring that the learning practices and approaches used by adolescents help them in storing information for the long-term (Alqurashi, 2018; Al-Bidawi, 2018). On the other hand, some studies also reflect that even when teachers fail at encouraging the adolescents for implementation of memory strategies, as a part of the enhancement of remembering skills a significant improvement can still be observed among the adolescents (Alqurashi, 2018). In a similar context, a study conducted by Alloway, Bibile and Lau (2013) revealed that memory strategies play a crucial role in increasing the ability of adolescents to memorise and revise the written as well as practical teachings that they are taught by the teachers. Taking the example of computer-based training as one of the key memory-enhancing strategies, it was identified in the study that memorising practices can assist the teachers in improving the neural activities of adolescents, which further can make them more goal-oriented and focused towards learning (Alloway, Bibile& Lau, 2013). In this manner, it can be interpreted from the findings of study 1 and literature that memory strategies play a vital role in driving the neural functions, level of concentration and focus on specific subjects.

The findings of study 2, associated with the role of memory strategy in a student's learning in alignment with the perspectives of the teacher, can also be examined using the

literature that has been conducted on the role of memory strategy in the field of education. Therefore, it has been identified from the study findings, as well as from the literary findings, that adoption of memory strategies impacts on the information retention ability and focusing skills of adolescents; this indicates that these strategies need to be promoted within the schools so that adolescents can easily memorise the lessons or learning that is being taught to them (Alloway, Banner and Smith, 2010). The views and experience of the teachers further revealed that through memory strategies adolescents can gain an opportunity to repeat or revise the academic learning again, which further can help them in boosting their learning skills and remembering power.

The findings of study 3, regarding the use and reliance on the self-test strategy by the adolescents as an effective strategy for memorising new information, can also be examined in light of the prevailing literature. In this respect, a study conducted by Augustin (2014) on self-regulation and self-test learning strategies reveals that the self-test involves repeated recalling of information and is an effective way to study and recall new information. Additional experiments conducted on self-testing reveal that retrieval helps in a more effective retention of information (Augustin, 2014). Another study by Renzulli (2015) involving a survey of 324 undergraduate adolescents reveals that the use of self-testing had a positive relationship with the GPA scored by the adolescents. However, despite the proven effectiveness of the strategies such as self-testing and recall strategies, adolescents from college do not incorporate this method and are restricted to re-reading their notes (Renzulli, 2015). The findings of the literature also revealed that the majority of the adolescents are usually unaware of the more active memorisation practices that help enhance and ease their learning (Renzulli, 2015). Rovers *et al*. (2018) also explain that most of the undergraduate adolescents have learned to exert control over their schedule. Such adolescents who can manage their time for studying and learning tend to be in an advantageous position in higher

education contexts in comparison to the adolescents who have not developed self-regulated strategies for learning. The literature asserts that self-regulation can be identified as a critical strategy for academic success that eases the process of memorisation for new information (Rovers *et al*. 2018).

The findings in study 4 were identified to be contrasting in comparison to the ones that were attained through the other three studies. It was determined that adoption of memory strategies did not have a significant impact on the scores of adolescents who participated in the conducting of this study. These findings were completely opposite to the ones that were explored in the previous studies, due to the fact that they did not indicate the role of memory strategies in completely transforming the academic performance of adolescents. In this regard, a study by Dunlosky *et al.* (2013) indicates some memory techniques can hamper the ability of adolescents to memorise facts like keyword mnemonics, some can enhance their comprehensive abilities, and some can boost both these aspects. For this purpose, adolescents sometimes prefer to develop or boost their memory by implementing those techniques that do not require assistance, and at times their memory strategies are developed on the basis of their choice or preference of the learning techniques (Dunlosky *et al*., 2013). On the basis of this study finding, it can be easily interpreted that adoption of specific memory strategies for all adolescents does not always have an impact in terms of academic performance, which is also denoted by the findings in the study.

Qureshi *et al*. (2017) assert that self-testing works as a strategy to memorise new information because the adolescents are required to make an additional effort to pull the information out of their memory, which is often absent when they tend to learn by merely reviewing their notes or re-reading the textbook a couple of times. The act of retrieval is claimed to be the most crucial part of the potent learning experience at higher studies level, and there is a large volume of evidence regarding the relative effectiveness of retrieval as

opposed to restudying. The literature highlights that self-testing is often believed to be useful for evaluation, in contrast to its actual effectiveness in respect of assessing their knowledge gaps and where to direct the focus of the learning efforts (Qureshi *et al*., 2017). The findings thereby further present significant evidence to confirm the effectiveness of the self-test strategy in facilitating the memorisation of new information among the undergraduate adolescents examined in this study and signifies their selection of a memorization strategy to be most effective and useful according to a wide range of scholars.

Overall, on the basis of the different tests applied in the studies undertaken in this research work and data collected from different sources, it can be concluded that memory strategies are perceived as being important by adolescents, students and teachers, and the reported use of memory strategies by students is related to their school grades (studies 1 and 2).

In study 3, it has been found that undergraduate students had a different memory performance after being trained in different memory strategies. This reflects that in memory strategy training, individual understanding and competencies can play an important role and the difference in the performance can be observed due to the different level of understanding and execution of the strategy in the most effective manner.

The findings of study 4 show this result in a different manner. Study 4 was a full-scale study that was performed to investigate the significance of memory strategy among a sample of adolescents. The study comprised a total of 120 adolescents including 77 boys and 43 girls.The results of study 4 reflected that training adolescents in different memory strategies did not lead to any difference in memory performance. There can be several reasons that the memory strategies were not found to be significant in adolescents but were significant for university students.

The first reason can be that university students are more mature and grown up as compared to adolescents and therefore they are more motivated to engage in memory strategies which will help them in remembering more information related to their subjects and will help them in scoring good marks.

The second reason could be that the study 4 contains 120 students out of which 77 were boys and only 43 girls were present. As it has been discussed earlier that women are more serious towards as compared to men in learning memory strategies. This lack of motivation among boys has made the memory strategies non significant for the study 4.

The third reason can be that adolescents studying in schools have lesser syllabus as compared to university students and because of which school students may not engage in memory strategies more seriously as compared to university students.

The findings of study 4 depicts that the effectiveness of a memory strategy depends on the cognitive and psychological states of individuals at different time points, so no particular memory strategy can be universally accepted for enhancing adolescents' learning. Further, this chapter presented the findings of all the four studies aligned to previous studies.

In conclusion, the findings of the studies have reflected that there is a difference in memory strategies when students report the memory strategies they use in their school life, and the teachers report on adolescents' behaviour, but there are no differences observed in memory performance when students received training in different memory strategies. However, it also indicated that there may be other factors that have an influence on the memory strategies used and that different strategies may be more effective for different age groups. This is related to the learning experiences of individuals, which may have more impact on learners who have had more exposure to different memory strategies.

6.3. Limitations

Limitations in research work are primarily related to the type of research instruments and data collection techniques integrated for accomplishing the research purpose. This particular study used both survey and interview methods as primary tools for collecting data and retrieving findings regarding memory strategies used, through adolescents and grades attained by them to further find the most effective memory strategy for adolescents in the KSA. However, there is a dearth of detailed evaluation and limited secondary sources. In addition, the research lacks a case study method and extensive assessment of scholarly articles that influence the quality and applicability of research findings. A larger difference in the sample of male and female participants is also identified as one of the limitations of the study. The interview questionnaire utilised in the four studies included only 3 questions, which limited a detailed investigation of the research issue. Further, the time needed to do the test was quite longer and student were feeling bored. The words used to test adolescents' memory were quite easy for the undergraduate adolescents. Additionally, the research produced specific results concerning the use and efficacy of memory strategies in the academic accomplishment of KSA adolescents. In addition, the study produced precise statistical outcomes with respect to the investigation of the role of memory in affecting adolescents' learning and opinions of teachers. The findings are specific in nature, so they cannot be applied in broad and generalised academic settings. Apart from this, the researcher encountered complexities in assimilating survey and interview data and executing the process of primary data collection, as it required the participation of teachers and adolescents.

6.4. Future Research

Academic practitioners can expand the research setting for extracting generalised data and producing widely applicable findings regarding the impact of memory strategies and

learning tactics on adolescents' performance, while exploring a similar research topic in future. Other than this, scholars can examine the link between teaching strategies and classroom practices on adolescents' academic performance in future and select a different set of dependent and independent research variables.

Teachers play an important role in students life as they can help in enhancing the memory of students with the help of different tricks. A study can be conducted where teachers make use of one memory strategy for every two weeks and then conduct a test to examine the score of students. In this way the teachers can use 3 to 4 memory strategies and conduct test after every strategy. This will help the teachers to identify which strategy is most effective and in which strategy students are scoring less marks. In this way teachers will be able to identify the best strategies that help their students to retain things more effectively.

Further, other research methods, such as a case study method, can also be integrated into future studies to produce detailed findings and extract in-depth information of factors that influence learning and memory strategies of adolescents and their role in improving academic grades. In this students of a particular university or school can be taken and detailed study on them can be conducted. Then more detailed study can be conducted for different age groups like for example in school the students can be divided into 3 groups. First group contains students from 4-6 class then second group contains students from 7-9 and third group contains students from 10-12. Along with students teachers can also be analysed for different class groups. The results can be generated for each and every student of school and then the overall results can be calculated to generate detailed results. This will help to generate more detailed results about which memory strategies are most effective among adolescents and it will also help us to identify in which age group which strategy is more effective. Secondary research tools like earlier studies which tell us about the memory strategies among adolescents, data published from reliable sources which provide a detailed

information about our topic, books and articles all can be used to gain a detailed understanding of the way adolescents memorise new information by carrying out a proper comparative analysis of tactics such as practice aloud, mental practice, written rehearsal, and self-test. Scholars can investigate different types of memory strategies used by the intermediate school adolescents of Saudi Arabia rather than relying on four types of memory strategies. In this instead of mentioning 3,4 strategies in questionnaire the students can be asked to write whatever memory strategy they use in order to remember the syllabus. It will help to not confine the results just for 3,4 strategies and detailed results will be obtained.

Apart from this, a comparative analysis of the memory strategies used by UK and KSA based adolescents can be conducted in future studies for producing novel insights relating to the research problem. It would be useful to analyse the difference in memory behaviour of adolescents in different countries. Moreover, it would also help to generalise the research outcomes through a large audience. The comparative analysis would help to determine a widely adopted and suitable memory strategy for the intermediate adolescents.

6.5. Conclusion

It can be concluded that memory is a crucial part of the student's life. It enhances student learning, thinking, and problem-solving skills. The requirement of a memory strategy is more important for undergraduate adolescents as compared to intermediate adolescents, as undergraduate adolescents need to gain knowledge of multiple subjects. It can be concluded from the study outcomes that Saudi adolescents are not focused on a specific memory strategy to memorise new information. However, the widely popular memory strategies used by the adolescents are self-test, the imagination of words, rehearsal, repeating, writing, and linking. The type of memory strategy also changes with the type of information they are memorising. On the other hand, memory strategies significantly increased the scores of

intermediate adolescents. Further, the findings of the in-depth interview showed that adolescents utilise a particular memory strategy as per their convenience and suitability; however, no specific memory strategy among practice aloud, mental practice, rehearsal, self-test can be considered better than the others.

It is further noted from the study findings that memory strategies may also differ according to learner age, gender, personality, and attitude. Among these factors, age is a significant factor that affects the student's choice of memory strategies. The younger adolescents use simple strategies such as re-reading and writing again and again, while the young adult use strategies that require deep mental processing by examining the word’s meaning.

It is also deduced from the study findings that self-testing is the most popular tool among adolescents to memorise new information. Apart from the self-testing tool, undergraduate adolescents also use a variety of other strategies such as rereading, study with group, real-life examples, highlighting the key information, and mnemonics. However, among all strategies used by the adolescents, self-testing is positively associated with the grade point average and academic performance of the adolescents. It is also recognised from the literature that memory strategies significantly contribute to the learning of the undergraduate adolescents and increase background knowledge and motivation of the adolescents. Moreover, the use of memory strategy also provides an opportunity for undergraduate adolescents to test their knowledge about a subject.

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Appendices

Appendix of Study 1

Appendix A: The interview schedule for teachers from intermediate schools

Participant No:

First the researcher will introduce himself and (this interview to find out your opinion about the role of memory in adolescents learning and your opinion about the effectiveness of memory strategies). (By the telephone).

Question 1: How important do you think memory is for adolescents' learning?

Question 2: I would like to ask you some questions about your opinion. What are the memory strategies that you encourage adolescents to use?

Question 3: Do you think these memory strategies are effective?

Question 4: Do you think the adolescents use more than one strategy at the same time?

Question 5: Why do think the adolescents do that?

Question 6: Do you believe these strategies have an effect on adolescents' performance?

Question 7: Why do you believe that?

Question 8: Do you think that the memory strategies are good for recall?

Question 9: Why do you think that?

Question 10: Do you believe some of memory strategies are easier than others to use? Why do you believe that?

Alternative questions for the interview schedule for teachers from intermediate schools

For Questions 1: What role do you think memory plays in student learning?

For Questions 2: What memory strategies (for remembering) do you encourage adolescents to use when you gave him a list of words?

For Questions 3: In your opinion do you think these memory strategies are improving the student's skills in remembering?

For Questions 4: Do your adolescents use more than one memory strategy at a time when they are tried to remember those words?

For Questions 5: If yes, why do your adolescents use multiple memory strategies?

For Questions 6: Do you think these strategies have an effect on adolescents' performance?

For Questions 7: If yes, why do memory strategies effect adolescents' performance?

For Questions 8: Does using these memory strategies effect recall?

For Questions 9: If yes, why do memory strategies effect recall?

For Questions 10: Do you think some of memory strategies are easier to use than others?

For Questions 11: If yes, why are some memory strategies easier?

Appendix B: Rating of the adolescents' performance (by the teachers)

Adolescents grades at the last test				
Name of student	Holy Qur'an	English Language	Arabic poetry	Maths& Sciences
Name of student				
Name of student				
Name of student				
Name of student				

Appendix of study 2

Appendix A: Survey Questionnaire schedule for adolescents from intermediate schools

Participant No:

Age:

Gender:

I would like to ask you about how you study for school tests and exams, especially how you remember passages in the Holy Qur'an, mathematics and science, Arabic poetry, and new vocabulary in the English language.

This questionnaire contains five pages, please do not turn the next page until you finish this page

Question 1: I would like to ask you some questions about how do you prepare for an exam and is there anything in particular that you do to help you remember?

Question 2: what technique do you use to help you remember?

Question 3: Do you do the same for each school subject or do you have different ways of remembering different subjects?

Question 4: what do you the same?

Question 5: why do you do the same?

Question 6: what do you do differently?

Question 7: why do you do it differently?

Question 8: Do you use more than one technique at the same time?

Question 9: Why do you do that?

Question 10: Do you believe some of memory techniques are easier than others to use?

Question 11: Why do you believe that?

Question 12: Which memory technique is easiest for you?

Question 13: What memory techniques do you use?

Technique #1	
Technique #2	
Technique #3	
Technique #4	
Technique #5	
Technique #6	

Question 14: When you are preparing for an exam do you use any of these memory strategies? *You can select more than one answer*.

	I practise the words or verses
	I test myself
	I read my books several times
	I use rhymes to remember words and facts
	I use pictures to remember words and facts

	I have a picture in my mind of where the words were on the page
	I sort words or facts into groups and remember the group
	I split large amounts of information into smaller pieces
	I sort words or facts into groups that have the same meaning
	I repeat the words or verses many times
	I use stories to remember words or facts or verses
	I imagine that I have placed the things I want to remember in my kitchen or another place that I like

Question 15: How often do you use these techniques?

	always	sometimes	never
I practise the words or verses			
I test myself			
I read my books several times			
I use rhymes to remember words and facts			
I use pictures to remember words and facts			
I have a picture in my mind of where the words were on the page			
I sort words or facts into groups and remember the group			

I split large amounts of information into smaller pieces			
I sort words or facts into groups that have the same meaning			
I repeat the words or verses many times			
I use stories to remember words or facts or verses			
I imagine that I have placed the things I want to remember in my kitchen or another place that I like			

Question 16: From which one of these techniques do you learn more?

☐ I practise the words or verses

☐ I test myself

☐ I read my books several times

☐ I use rhymes to remember words and facts

☐ I use pictures to remember words and facts

☐ I have a picture in my mind of where the words were on the page

☐ I sort words or facts into groups and remember the group

☐ I split large amounts of information into smaller pieces

☐ I sort words or facts into groups that have the same meaning

☐ I repeat the words or verses many times

☐ I use stories to remember words or facts or verses

☐ I imagine that I have placed the things I want to remember in my kitchen or another place that I like

Question 17: How would you rate the useful to use these techniques in learning?

☐ Very useful

☐ Somewhat useful

☐ Average

☐ Somewhat not useful

☐ Not at all useful

Question 18: How successful do you feel when you use these memory techniques?

☐ Completely successful

☐ Very successful

☐ Somewhat successful

☐ Slightly successful

☐ Not at all successful

Appendix B: SPSS Output of Study 2

Table 5:

Results of Regression Analysis: Adolescents Score in English and Feeling Success when using these methods

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.149[a]	.022	.016	.79330

a. Predictors: (Constant), adolescents score in English

b. Dependent Variable: feeling successes when using these methods

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.464	1	2.464	3.915	.049[b]
	Residual	108.873	173	.629		
	Total	111.337	174			

a. Dependent Variable: feeling successes when using these methods

b. Predictors: (Constant), adolescents score in English

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.881	.224		17.319	.000	3.439	4.324
	adolescents score in English	.012	.006	.149	1.979	.049	.000	.024

a. Dependent Variable: feeling success when using these methods

Table 6

Regression Result Analysis: Adolescents Score in English and Benefit of Using these methods

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.262[a]	.069	.063	.66330

a. Predictors: (Constant), adolescents score in English

b. Dependent Variable: benefit of using these methods

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.622	1	5.622	12.779	.000[b]
	Residual	76.115	173	.440		
	Total	81.737	174			

a. Dependent Variable: benefit of using these methods

b. Predictors: (Constant), adolescents score in English

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	4.006	.187		21.379	.000	3.636	4.376
	adolescents score in English	.018	.005	.262	3.575	.000	.008	.028

a. Dependent Variable: benefit of using these methods

Appendix of Study 3:

Appendix A: Example of lists of words

Amphibian	**Insect**	**Marker**	**Sleep**
Tadpole	**Caterpillar**	**Paintbrush**	**Bed**
Frog	**Chrysalis**	**Blanket**	**Pencil**
Toad	**Butterfly**	**Crayon**	**pillow**

(a)

Moth	**Bird**	**Pants**	**Playground**
Caterpillar	**Feathers**	**Jacket**	**Swing**
Cocoon	**Beak**	**Shirt**	**Slide**
Antenna	**Nest**	**Socks**	**Monkey bars**

(b)

Appendix B: The questionnaire schedule for adolescents from Arab adolescents in UK and intermediate schools in Saudi

Participant No:

Age:

Gender:

I would like to ask you about how you normally memorise new information.

This questionnaire contains three questions, please try to answer these questions freely.

Question 1: How do you normally memorise new information

Question 3: which type of memory strategy do you use?

Question 2: why do you use that particular approach to memorise these words?

Appendix C :SPSS Output of Study 4

Table 1: *Descriptive Statistics*

Group Statistics

	STUDENT-GENDER	N	Mean	Std. Deviation	Std. Error Mean
Practice aloud WR	MALE	33	8.9697	2.53087	.44057
	FEMALE	9	9.8889	2.57121	.85707
Mental practice WR	MALE	33	10.0909	2.67352	.46540
	FEMALE	9	10.8889	1.83333	.61111
Rehearsal WR	MALE	33	10.2121	2.65468	.46212

	FEMALE	9	8.2222	2.58736	.86245
Self-test WR	MALE	33	11.6364	2.11864	.36881
	FEMALE	9	12.3333	1.93649	.64550

Table 2: *Descriptive Statistics of scores of Adolescents corresponding to different Memory Strategies*

Descriptive Statistics

	Mean	Std. Deviation	N
Practice aloud WR	9.1667	2.53672	42
Mental practice WR	10.2619	2.51880	42
Rehearsal WR	9.7857	2.73670	42
Self-test WR	11.7857	2.07818	42

Table 3: *ANOVA test: Tests of Within-Subjects Effects*

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Type memory strategy	Sphericity Assumed	157.405	3	52.468	10.578	.001	.205
	Greenhouse-Geisser	157.405	2.391	65.821	10.578	.001	.205
	Huynh-Feldt	157.405	2.550	61.735	10.578	.001	.205
	Lower-bound	157.405	1.000	157.405	10.578	.002	.205
Error(type memory strategy)	Sphericity Assumed	610.095	123	4.960			
	Greenhouse-Geisser	610.095	98.048	6.222			
	Huynh-Feldt	610.095	104.537	5.836			
	Lower-bound	610.095	41.000	14.880			

Table 4: *ANOVA test: Tests of Within-Subjects Effects*

Pairwise Comparisons

Measure: MEASURE_1

(I) type memory strategy	(J) type memory strategy	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
1	2	-1.095*	.330	.002	-1.762	-.429
	3	-.619	.385	.116	-1.398	.159
	4	-2.619*	.522	.000	-3.674	-1.564
2	1	1.095*	.330	.002	.429	1.762
	3	.476	.539	.382	-.613	1.565
	4	-1.524*	.549	.008	-2.632	-.416
3	1	.619	.385	.116	-.159	1.398
	2	-.476	.539	.382	-1.565	.613
	4	-2.000*	.543	.001	-3.097	-.903
4	1	2.619*	.522	.000	1.564	3.674
	2	1.524*	.549	.008	.416	2.632
	3	2.000*	.543	.001	.903	3.097

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 5: Information of the variable that has been included in the model

Within-Subjects Factors	
Measure: MEASURE_1	
Type memory strategy	Dependent Variable
1	Practice aloud WR
2	Mental practice WR
3	Rehearsal WR
4	Self-test WR

Table 6: Between Subject Factors

Between-Subjects Factors		
	Value Label	N

GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE, WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD, SELF-TEST)	1.00	Group 1	22
	2.00	Group 2	20

Table 7: Descriptive Statistics

Descriptive Statistics

	GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE, WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD, SELF-TEST)	Mean	Std. Deviation	N
Practice aloud WR	Group 1	8.9091	2.50541	22
	Group 2	9.4500	2.60516	20
	Total	9.1667	2.53672	42
Mental practice WR	Group 1	8.9091	2.50541	22
	Group 2	11.7500	1.51744	20
	Total	10.2619	2.51880	42
Rehearsal WR	Group 1	10.0909	2.87699	22
	Group 2	9.4500	2.60516	20

	Total	9.7857	2.73670	42
Self-test WR	Group 1	11.6818	1.91203	22
	Group 2	11.9000	2.29186	20
	Total	11.7857	2.07818	42

Table 8: Repeated Measure ANOVA (Tests of Within-Subjects Effects)

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Type memory strategy	Sphericity Assumed	157.366	3	52.455	11.644	.000	.225
	Greenhouse-Geisser	157.366	2.307	68.202	11.644	.000	.225
	Huynh-Feldt	157.366	2.518	62.498	11.644	.000	.225
	Lower-bound	157.366	1.000	157.366	11.644	.001	.225
Type memory strategy * Group	Sphericity Assumed	69.485	3	23.162	5.141	.002	.114

code	Greenhouse-Geisser	69.485	2.307	30.115	5.141	.005	.114
	Huynh-Feldt	69.485	2.518	27.596	5.141	.004	.114
	Lower-bound	69.485	1.000	69.485	5.141	.029	.114
Error(Type memory strategy)	Sphericity Assumed	540.610	120	4.505			
	Greenhouse-Geisser	540.610	92.294	5.858			
	Huynh-Feldt	540.610	100.718	5.368			
	Lower-bound	540.610	40.000	13.515			

Table 9: *Repeated Measure ANOVA (Tests of Between-Subjects Effects)*

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	17671.052	1	17671.052	1884.575	.000	.979
Group code	22.933	1	22.933	2.446	.126	.058

Error	375.067	40	9.377		

Evaluate memory behaviour: How do the adolescents apply new strategies they have learned?

Table 10: Paired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-TEST	7.3333	42	3.15198	.48636
	POST-TEST	11.8571	42	2.09030	.32254

Table 11: Paired Samples Correlations

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE-TEST & POST-TEST	42	.463	.002

Table 12: Paired Samples t-Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE-TEST - POST-TEST	-4.52381	2.86474	.44204	-5.41653	-3.63109	-10.234	41	.000

Table 13: Independent Samples Test

Group Statistics

	STUDENT-GENDER	N	Mean	Std. Deviation	Std. Error Mean
Post-test. Minus Pre-test	MALE	33	4.6667	3.13913	.54645
	FEMAL	9	4.0000	1.50000	.50000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post-test. Minus Pre-test	Equal variances assumed	5.700	.022	.614	40	.543	.66667	1.08556	-1.52734	2.86068
	Equal variances not assumed			.900	28.396	.376	.66667	.74068	-.84960	2.18293

Table 14: Within-Subjects Factors

Within-Subjects Factors

Measure: MEASURE_1

strategies	Dependent Variable

1	Practice aloud WR
2	Mental practice WR
3	Rehearsal WR
4	Self-test WR

Table 15: Within-Subjects Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Strategies	Sphericity Assumed	135.881	3	45.294	9.561	.000
	Greenhouse-Geisser	135.881	2.313	58.747	9.561	.000
	Huynh-Feldt	135.881	2.525	53.822	9.561	.000
	Lower-bound	135.881	1.000	135.881	9.561	.004
strategies * GENDER	Sphericity Assumed	41.595	3	13.865	2.927	.037

	Greenhouse-Geisser	41.595	2.313	17.983	2.927	.051
	Huynh-Feldt	41.595	2.525	16.476	2.927	.046
	Lower-bound	41.595	1.000	41.595	2.927	.095
Error(strategies)	Sphericity Assumed	568.500	120	4.738		
	Greenhouse-Geisser	568.500	92.519	6.145		
	Huynh-Feldt	568.500	100.985	5.630		
	Lower-bound	568.500	40.000	14.213		

Table 16: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	11957.461	1	11957.461	1202.716	.000
GENDER	.318	1	.318	.032	.859
Error	397.682	40	9.942		

Appendix of Study 4

Appendix A: SPSS Output for Study 4

Table 1: Testing of Sphericity

Mauchly's Test of Sphericity

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
factor1	.811	18.350	5	.003	.900	.931	.333

Tests the null hypothesis that the error covariance matrix of the ortho-normalised transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

Within Subjects Design: factor1

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 2: Testing of Sphericity

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within	Mauchly's	Approx.	df	Sig.	Epsilon[b]

Subjects Effect	W	Chi-Square			Greenhouse-Geisser	Huynh-Feldt	Lower-bound
pre_post	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the ortho-normalised transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + GENDER + controlORintevention + GENDER * controlORintevention

Within Subjects Design: pre_post

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 3

Mauchly's Test of Sphericity

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
pre_post	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the ortho-normalised transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + controlORintevention

Within Subjects Design: pre_post

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 4: Multivariate Tests for analysing difference in pre-test and post-test scores of Males

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
pre_post	Pillai's Trace	.002	.130[b]	1.000	75.000	.720	.002	.130	.065
	Wilks' Lambda	.998	.130[b]	1.000	75.000	.720	.002	.130	.065
	Hotelling's Trace	.002	.130[b]	1.000	75.000	.720	.002	.130	.065
	Roy's Largest Root	.002	.130[b]	1.000	75.000	.720	.002	.130	.065
pre_post * controlORintevention	Pillai's Trace	.001	.089[b]	1.000	75.000	.766	.001	.089	.060

	Wilks' Lambda	.999	.089[b]	1.000	75.000	.766	.001	.089	.060
	Hotelling's Trace	.001	.089[b]	1.000	75.000	.766	.001	.089	.060
	Roy's Largest Root	.001	.089[b]	1.000	75.000	.766	.001	.089	.060

a. Design: Intercept + controlORintevention

Within Subjects Design: pre_post

b. Exact statistic

c. Computed using alpha = .05

Table 4: Within-Subjects Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
factor1	Sphericity Assumed	5.956	3	1.985	.472	.702	.005

	Greenhouse-Geisser	5.956	2.699	2.206	.472	.682	.005
	Huynh-Feldt	5.956	2.792	2.133	.472	.688	.005
	Lower-bound	5.956	1.000	5.956	.472	.494	.005
Error(factor)	Sphericity Assumed	1122.044	267	4.202			
	Greenhouse-Geisser	1122.044	240.241	4.670			
	Huynh-Feldt	1122.044	248.477	4.516			
	Lower-bound	1122.044	89.000	12.607			

Table 6: Tests of Within-Subjects Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
factor1	Sphericity Assumed	21.849	3	7.283	1.938	.124	.022
	Greenhouse-Geisser	21.849	2.641	8.273	1.938	.132	.022

	Huynh-Feldt	21.849	2.761	7.913	1.938	.129	.022
	Lower-bound	21.849	1.000	21.849	1.938	.167	.022
factor1 * Practice aloud OR	Sphericity Assumed	130.149	3	43.383	11.547	.000	.116
	Greenhouse-Geisser	130.149	2.641	49.282	11.547	.000	.116
	Huynh-Feldt	130.149	2.761	47.137	11.547	.000	.116
	Lower-bound	130.149	1.000	130.149	11.547	.001	.116
Error(factor1)	Sphericity Assumed	991.896	264	3.757			
	Greenhouse-Geisser	991.896	232.399	4.268			
	Huynh-Feldt	991.896	242.972	4.082			
	Lower-bound	991.896	88.000	11.272			

Table 7: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects
Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	58122.168	1	58122.168	4453.467	.000	.981
Practicolud OR	143.113	1	143.113	10.966	.001	.111
Error	1148.488	88	13.051			

Table 8: *Descriptive Statistics: T-test*

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest	14.4500	120	1.91785	.17508
	posttest	14.4083	120	2.13217	.19464

Table 9: *Paired Samples t-Test*

Paired Samples Test

Paired Differences					t	df	Sig. (2-

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				tailed)
					Lower	Upper			
Pair 1	pretest - posttest	.04167	1.76994	.16157	-.27826	.36160	.258	119	.797

Table 10: *Independent Samples Statistics*

Group Statistics

	STUDENT-GENDER	N	Mean	Std. Deviation	Std. Error Mean
Practice aloud	MALE	60	13.9667	2.37192	.30621
	FEMALE	30	12.7667	3.47090	.63370
Mental practice	MALE	60	14.8833	2.00078	.25830
	FEMALE	30	11.5333	2.62262	.47882
Rehearsal W	MALE	60	13.9167	2.18850	.28253
	FEMALE	30	12.9333	2.21178	.40381
Self-test	MALE	60	13.8167	2.98863	.38583
	FEMALE	30	14.0000	1.57568	.28768

Table 11: *Independent Samples t-Test*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Practice aloud	Equal variances assumed	8.465	.005	1.929	88	.057	1.20000	.62218	-.03644	2.43644
	Equal variances not assumed			1.705	42.972	.095	1.20000	.70380	-.21938	2.61938
Mental practice	Equal variances assumed	4.283	.041	6.733	88	.000	3.35000	.49752	2.36128	4.33872

	Equal variances not assumed			6.158	46.402	.000	3.35000	.54405	2.25514	4.44486
Rehearsal	Equal variances assumed	.037	.848	2.002	88	.048	.98333	.49109	.00740	1.95926
	Equal variances not assumed			1.995	57.562	.051	.98333	.49284	-.00335	1.97002
Self- test	Equal variances assumed	5.594	.020	-.314	88	.754	-.18333	.58338	-1.34268	.97601
	Equal variances not assumed			-.381	87.694	.704	-.18333	.48127	-1.13981	.77314

Table 12: *2x2x2 Multivariate test*

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
pre_post	Pillai's Trace	.007	.865[b]	1.000	116.000	.354	.007	.865	.152
	Wilks' Lambda	.993	.865[b]	1.000	116.000	.354	.007	.865	.152
	Hotelling's Trace	.007	.865[b]	1.000	116.000	.354	.007	.865	.152
	Roy's Largest Root	.007	.865[b]	1.000	116.000	.354	.007	.865	.152
pre_post * GENDER	Pillai's Trace	.002	.177[b]	1.000	116.000	.674	.002	.177	.070
	Wilks' Lambda	.998	.177[b]	1.000	116.000	.674	.002	.177	.070
	Hotelling's Trace	.002	.177[b]	1.000	116.000	.674	.002	.177	.070

	Roy's Largest Root	.002	.177[b]	1.000	116.000	.674	.002	.177	.070
pre_post * controlORintevention	Pillai's Trace	.026	3.113[b]	1.000	116.000	.080	.026	3.113	.417
	Wilks' Lambda	.974	3.113[b]	1.000	116.000	.080	.026	3.113	.417
	Hotelling's Trace	.027	3.113[b]	1.000	116.000	.080	.026	3.113	.417
	Roy's Largest Root	.027	3.113[b]	1.000	116.000	.080	.026	3.113	.417
pre_post * GENDER *controlORintevention	Pillai's Trace	.015	1.805[b]	1.000	116.000	.182	.015	1.805	.266
	Wilks' Lambda	.985	1.805[b]	1.000	116.000	.182	.015	1.805	.266
	Hotelling's Trace	.016	1.805[b]	1.000	116.000	.182	.015	1.805	.266
	Roy's Largest Root	.016	1.805[b]	1.000	116.000	.182	.015	1.805	.266

a. Design: Intercept + GENDER + controlORintevention + GENDER * controlORintevention

Within Subjects Design: pre_post

b. Exact statistic

c. Computed using alpha = .05

Table 13:*2x2x2 Multivariate test*

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
pre_post	Pillai's Trace	.031	1.315[b]	1.000	41.000	.258	.031	1.315	.202
	Wilks' Lambda	.969	1.315[b]	1.000	41.000	.258	.031	1.315	.202
	Hotelling's Trace	.032	1.315[b]	1.000	41.000	.258	.031	1.315	.202
	Roy's Largest Root	.032	1.315[b]	1.000	41.000	.258	.031	1.315	.202
pre_post * controlORintevention	Pillai's Trace	.145	6.957[b]	1.000	41.000	.012	.145	6.957	.731

	Wilks' Lambda	.855	6.957[b]	1.000	41.000	.012	.145	6.957	.731
	Hotelling's Trace	.170	6.957[b]	1.000	41.000	.012	.145	6.957	.731
	Roy's Largest Root	.170	6.957[b]	1.000	41.000	.012	.145	6.957	.731

a. Design: Intercept + controlORintevention

Within Subjects Design: pre_post

b. Exact statistic

c. Computed using alpha = .05

Table 5.11

Multiple Comparisons

Measure: MEASURE_1

Bonferroni

(I) GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	(J) GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Group 1	Group 2	-1.6830*	.46753	.002	-2.8244	-.5417
	Group 3	-1.0142	.45980	.090	-2.1367	.1082
Group 2	Group 1	1.6830*	.46753	.002	.5417	2.8244
	Group 3	.6688	.46381	.459	-.4634	1.8010

Group 3	Group 1	1.0142	.45980	.090	-.1082	2.1367
	Group 2	-.6688	.46381	.459	-1.8010	.4634

Based on observed means.

The error term is Mean Square(Error) = 3.223.

*. The mean difference is significant at the .05 level.

Table 5.12

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
pre_post	Sphericity Assumed	1.342	1	1.342	.865	.354	.007	.865	.152
	Greenhouse-Geisser	1.342	1.000	1.342	.865	.354	.007	.865	.152
	Huynh-Feldt	1.342	1.000	1.342	.865	.354	.007	.865	.152
	Lower-bound	1.342	1.000	1.342	.865	.354	.007	.865	.152
pre_post * GENDER	Sphericity Assumed	.275	1	.275	.177	.674	.002	.177	.070
	Greenhouse-Geisser	.275	1.000	.275	.177	.674	.002	.177	.070
	Huynh-Feldt	.275	1.000	.275	.177	.674	.002	.177	.070
	Lower-bound	.275	1.000	.275	.177	.674	.002	.177	.070
pre_post * controlORintervention	Sphericity Assumed	4.828	1	4.828	3.113	.080	.026	3.113	.417
	Greenhouse-Geisser	4.828	1.000	4.828	3.113	.080	.026	3.113	.417
	Huynh-Feldt	4.828	1.000	4.828	3.113	.080	.026	3.113	.417
	Lower-bound	4.828	1.000	4.828	3.113	.080	.026	3.113	.417
pre_post * GENDER *controlORintervention	Sphericity Assumed	2.799	1	2.799	1.805	.182	.015	1.805	.266
	Greenhouse-Geisser	2.799	1.000	2.799	1.805	.182	.015	1.805	.266

	Huynh-Feldt	2.799	1.000	2.799	1.805	.182	.015	1.805	.266
	Lower-bound	2.799	1.000	2.799	1.805	.182	.015	1.805	.266
Error(pre_post)	Sphericity Assumed	179.906	116	1.551					
	Greenhouse-Geisser	179.906	116.000	1.551					
	Huynh-Feldt	179.906	116.000	1.551					
	Lower-bound	179.906	116.000	1.551					

a. Computed using alpha = .05

Table 5.11.1

tTests of Within-Subjects Effects

Measure: MEASURE_1

GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Group 1	Strategy	Sphericity Assumed	91.892	3	30.631	7.090	.000	.196	21.270	.977
		Greenhouse-Geisser	91.892	1.912	48.048	7.090	.002	.196	13.560	.908
		Huynh-Feldt	91.892	2.044	44.950	7.090	.002	.196	14.494	.922
		Lower-bound	91.892	1.000	91.892	7.090	.013	.196	7.090	.730
	Error(Strategy)	Sphericity Assumed	375.858	87	4.320					

		Greenhouse-Geisser	375.858	55.462	6.777					
		Huynh-Feldt	375.858	59.284	6.340					
		Lower-bound	375.858	29.000	12.961					
Group 2	Strategy	Sphericity Assumed	36.784	3	12.261	3.286	.025	.105	9.857	.732
		Greenhouse-Geisser	36.784	2.939	12.515	3.286	.026	.105	9.657	.726
		Huynh-Feldt	36.784	3.000	12.261	3.286	.025	.105	9.857	.732
		Lower-bound	36.784	1.000	36.784	3.286	.081	.105	3.286	.417
	Error(Strategy)	Sphericity Assumed	313.466	84	3.732					
		Greenhouse-Geisser	313.466	82.297	3.809					
		Huynh-Feldt	313.466	84.000	3.732					
		Lower-bound	313.466	28.000	11.195					
Group 3	Strategy	Sphericity Assumed	16.548	3	5.516	1.692	.174	.053	5.075	.429
		Greenhouse-Geisser	16.548	2.318	7.139	1.692	.187	.053	3.921	.371
		Huynh-Feldt	16.548	2.523	6.558	1.692	.183	.053	4.269	.389
		Lower-bound	16.548	1.000	16.548	1.692	.203	.053	1.692	.242
	Error(Strategy)	Sphericity Assumed	293.452	90	3.261					
		Greenhouse-Geisser	293.452	69.537	4.220					
		Huynh-Feldt	293.452	75.704	3.876					
		Lower-bound	293.452	30.000	9.782					

a. Computed using alpha = .05

Table 5.11.2

Post-hoc test to see strategy differences in Group 1, Group 2 and Group 3

Pairwise Comparisons

Measure: MEASURE_1

GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Group 1	1	2	1.233	.701	.089	-.200	2.667
		3	-.167	.616	.789	-1.427	1.093
		4	-1.233	.652	.068	-2.566	.099
	2	1	-1.233	.701	.089	-2.667	.200
		3	-1.400*	.373	.001	-2.163	-.637
		4	-2.467*	.469	.000	-3.426	-1.507
	3	1	.167	.616	.789	-1.093	1.427
		2	1.400*	.373	.001	.637	2.163
		4	-1.067*	.271	.000	-1.621	-.513
	4	1	1.233	.652	.068	-.099	2.566
		2	2.467*	.469	.000	1.507	3.426
		3	1.067*	.271	.000	.513	1.621
Group 2	1	2	-.966	.510	.069	-2.010	.079
		3	.517	.498	.308	-.503	1.537
		4	.276	.511	.593	-.770	1.322
	2	1	.966	.510	.069	-.079	2.010
		3	1.483*	.467	.004	.526	2.440
		4	1.241*	.543	.030	.129	2.353
	3	1	-.517	.498	.308	-1.537	.503
		2	-1.483*	.467	.004	-2.440	-.526
		4	-.241	.513	.641	-1.291	.809
	4	1	-.276	.511	.593	-1.322	.770
		2	-1.241*	.543	.030	-2.353	-.129
		3	.241	.513	.641	-.809	1.291
Group 3	1	2	-.871*	.409	.041	-1.706	-.036
		3	-.387	.437	.382	-1.279	.505

		4	.032	.600	.957	-1.193	1.258
	2	1	.871*	.409	.041	.036	1.706
		3	.484	.314	.134	-.158	1.125
		4	.903	.455	.056	-.026	1.833
	3	1	.387	.437	.382	-.505	1.279
		2	-.484	.314	.134	-1.125	.158
		4	.419	.488	.397	-.577	1.416
	4	1	-.032	.600	.957	-1.258	1.193
		2	-.903	.455	.056	-1.833	.026
		3	-.419	.488	.397	-1.416	.577

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 5.11.3

Pairwise Comparisons

Dependent Variable: Total_number_of_words_remembered

(I) GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	(J) GROUP 1(PRACTICE ALOUD, MENTAL PRACTICE,WRITTEN REHEARSAL, SELF-TEST) GROUP 2 (MENTAL PRACTICE, WRITTEN REHEARSAL, PRACTICE ALOUD,SELF-TEST)	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Group 1	Group 2	-6.732*	1.870	.001	-10.449	-3.015
	Group 3	-4.057*	1.839	.030	-7.713	-.401
Group 2	Group 1	6.732*	1.870	.001	3.015	10.449
	Group 3	2.675	1.855	.153	-1.012	6.363
Group 3	Group 1	4.057*	1.839	.030	.401	7.713
	Group 2	-2.675	1.855	.153	-6.363	1.012

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).